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The description of each author or committee member is given according to the custom of his country



# ABBREVIATIONS

A B B	Advanced Blood Bank
A B S D	Army Blood Supply Depot
A D M S	Assistant Director of Medical Services
A D S	Advanced Dressing Station
A S R S	Air/Sea Rescue Service
B I A	British Liberation Army
B T U	Blood Transfusion Unit
C C S	Casualty Clearing Station
C M F	Central Mediterranean Force
D A D M S	Deputy Assistant Director of Medical Services
D D M S	Deputy Director of Medical Services
D Z	Dropping Zone
E M S	Emergency Medical Service, United Kingdom
E T O U S A	European Theater of Operations, United States Army
F A	Field Ambulance
F D S	Field Dressing Station
F S D	Field Supply Depot
F S U	Field Surgical Unit
F T U	Field Transfusion Unit
L S T	Landing Ships, Tank
M/C	Motor Cyclist
M/T	Motor Transport
M A C	Motor Ambulance Convoy
M C	U K Military Cross
M C	U S Medical Corps
M D S	Main Dressing Station
M E F	Middle East Force
M P	Military Police
R.A.M P	Recovered Allied Military Personnel
R A P	Regimental Aid Post.
S T.	Supply and Transport.
V A D	Voluntary Aid Detachment
W O S B	War Office Selection Board
W W	Walking Wounded
Z I	Zone of the Interior, i e U S A

## FOREWORD

BY MAJOR-GENERAL PAUL R. HAWLEY, U.S. ARMY

War offers few opportunities to salvage good from the tragic wastage. In sponsoring the Inter allied Medical Conferences, the Royal Society of Medicine of London seized a rare opportunity and exploited it fully.

The momentary value of this program was measurable in terms of improved care of casualties and of heightened morale of medical officers. But there are other continuing and perhaps even more significant, benefits which are not so readily measurable. In ordinary times it is the few prominent members of the medical profession who are privileged to associate with colleagues abroad. The Inter-allied Conferences extended this privilege to thousands of the younger men in the profession from at least eight different countries. Acquaintances were formed of which a goodly number ripened into enduring friendships. In an age in which misunderstanding arising out of a want of appreciation of points of view of other peoples, is one of the most potent causes of international distrust, such close association of upright men with a common professional background must exert a real influence in furthering on earth peace good will toward men.

The medical officers of the United Nations, whose good fortune it was to have served in Britain during this War, are deeply indebted to Major-General Sir Henry Tidy. It was he who conceived the program, he who devoted his time and his energy unsparingly in ensuring its success. Although we can never discharge this debt we shall never repudiate it. And so on behalf of the officers of the Medical Corps of the United States Army who profited so richly from his labors - and I am confident I shall not presume if I speak as well for the medical officers of our splendid Allies - I have the honor to acknowledge our great obligation to Sir Henry and to tender to him this sincerest expression of our lasting gratitude.

PAUL R. HAWLEY  
Major-General U.S. Army  
(Formerly) Chief Surgeon  
European Theater of Operations



## PREFACE

The Inter allied Conferences on War Medicine were held at the house of the Royal Society of Medicine, and this body convened the meetings and undertook the responsibility of the general organization. A Committee of the heads of the various allied medical services or their representatives met after each conference, settled the subject for the next meeting and chose the speakers. The Services concerned arranged for the presence of the speakers, sometimes involving a long flight from an overseas base or from a campaign in active progress.

The first meeting was held on December 7 1942 and the last on July 8 1945. In the course of three seasons there were 24 conferences with a total attendance of over 6,500 officers of the Allied Medical Services.

The first suggestion of such meetings came from Major (now General) Gallemaerts who reached this country from Belgium after prolonged wanderings on land and sea. In April 1942 he suggested to the British War Office that conferences on war medicine should be arranged. The suggestion was approved in principle at a meeting of representatives of the Allied Services, but did not materialize owing to difficulty in organization. There was already at that time in the United Kingdom a number of medical officers of many of the Allies, and American troops commenced to arrive shortly afterwards, and soon were present in the country in considerable numbers. Very few of the American officers had experience of warfare or knowledge of what active service involves. Many of the British officers stationed in the United Kingdom were in a similar position. It was realized that it was important to bring as many of these as possible in contact with the actual facts of warfare, related by those with technical knowledge and personal experience.

Colonel (later Major-General) Elliott C. Cutler who had recently arrived from the U.S. approached an old friend, Mr. L. R. Broster at that time Surgical Secretary of the Royal Society of Medicine. After some preliminary conversations, a meeting was held in October 1942 of the heads of the medical services of the Allies in this country. The Royal Society of Medicine offered accommodation and clerical assistance for the organization of the meetings. The heads of the medical services welcomed the proposition and formed an organizing committee. The meetings were to be confined to officers of the Services, to be held strictly under security and no reports were to be made public. The Air Force was especially helpful in assisting the presence of speakers as when a brigadier was flown from North Africa during a campaign and flown back the day after the meeting.

The objects of the conferences were laid down by the Committee as follows – For the interchange and communication of medical experiences in the Field and of the practical application of medicine to the needs of warfare, and for the exposition of the general principles of administration and organization of the medical services

The conferences were not to be concerned with strictly scientific matters which would be dealt with by other bodies, such as meetings of the Sections of the Royal Society of Medicine, various postgraduate bodies, and the excellent medical societies which were formed in many military hospitals and medical units. Senior officers would in general describe matters of administration and organization while experiences in the Field would come from junior officers from the forward areas and front line

A few remarks may be made on some of the communications

## I GENERAL ACCOUNTS OF CAMPAIGNS

General Barnsley's fascinating account of the Abyssinian campaign opened the first meeting. One may note his concluding remark 'Surely never in the story of human conflict have so many run away from so few'. In contrast to General Barnsley's account of a victorious campaign was Colonel Large's description of the tragic episode in Greece

Colonel Holst, Director-General of the Norwegian Medical Service, has an unrivalled experience of campaigning under winter conditions in northern latitudes. His conclusion is noteworthy that 'an expeditionary force from the U.K. would not be able to conduct mobile warfare under arctic conditions in hard winter or heavy snow'. The possibility of an expeditionary force from the U.K. to Norway had been under consideration. In a later communication on Trench Foot, which he declared to be preventable, he stated that during the Norwegian campaign of 1944-45 in Finmark no case of trench foot or frostbite occurred during the trek of a large patrol over 600 miles on skis in open country. The Conferences followed the progress of the war through Libya, Tunis, Sicily and Italy, and then from D-day to the German concentration camps. It is to be regretted that no communications were possible on the campaigns in Burma, the Far East and the Pacific. No officers were available, and further, in the condition of the campaign, secrecy was absolutely essential.

## 2 PERSONAL EXPERIENCES OF OFFICERS IN SPECIAL EPISODES

This group included stories of some of the most famous episodes of the war, related calmly by junior officers whose part in the incident had usually involved great personal courage. Most of these experiences, though unfortunately not all, are included in this volume. Among the most striking stories were those of a medical officer who volunteered to stay behind at Dunkirk to look after the wounded who could not

be evacuated and subsequently escaped and returned to the United Kingdom the story of the Arctic convoy, the Dieppe raid, a medical officer parachuted into Yugoslavia a French medical officer in the march from Lake Chad to Algeria, a medical officer parachuted into Arnhem whom the Dutch finally helped to escape and the relief of Bastogne. One of the most dramatic personal narratives was the description by Professor Richet, who came from Paris for the meeting of 15 months spent in the concentration camp at Buchenwald. A gasp of astonishment from the crowded hall followed his statement 'Buchenwald was a good camp'. Yes, he continued, it was a good camp for two reasons, first there was no torture and secondly, there was no gas chamber. Professor Richet entered the camp with 47 compatriots after five or six weeks three were still alive, at the end he was the sole survivor. 'Buchenwald was a good camp'.

The story of the worst Russian convoy of the war ends. We arrived back with 8 left out of 37 merchant ships.

Major Newman told of the bravery of French and Belgian women in assisting starving and exhausted British prisoners of war many of them wounded who were being marched from Dunkirk to Germany. A woman approached the camp carrying a large parcel. She was stopped at the gate at the point of a bayonet and told that entry was *verboden*. She pushed up the bayonet with her hand, kissed the sentry and walked on.

### 3. VARIOUS SPECIAL SUBJECTS

Some subjects recurred periodically at the conferences, exhibiting changes and progress as the war advanced and experience was obtained. One may mention malaria, the psychological aspects of warfare and selection of officers and personnel, blood transfusion, the position of advanced surgical teams, infective hepatitis and general problems of evacuation of wounded by land, sea and air.

### 4. D DAY

D-day and the events immediately following occupied nearly two meetings. Various speakers described the preliminary organization, the first landing on the Normandy coast, the evacuation and treatment of wounded on the L.S.T. the reception, sorting and treatment of casualties on the near shore, and later the development of evacuation by air.

### 5. GERMAN CONCENTRATION CAMPS

The Conference held on June 1, 1945, described conditions in German concentration camps, and discussed the treatment of starvation. The horrors of Belsen, the starvation of large areas in Holland and the death marches of prisoners-of-war across hundreds of miles in Germany in the snow were fresh in everybody's mind. As is well

known, groups of scientific researchers had been studying experimentally the value of protein hydrolysates in advanced starvation. The unexpected discovery of Belsen seemed to call for their use on a large scale, and within a few days a special team was sent there under the Medical Research Council. At a meeting of the Section of Medicine of the Royal Society of Medicine, held a week previously, the speakers were thrown on the value of protein hydrolysates by speakers who had been in Belsen. It was decided that the question should be considered more fully at the forthcoming conference. Certain members of the research teams in Holland and Belsen were brought over to give their experiences and opinions. It was evident that the administration of protein hydrolysates was impracticable as a method of treating enormous numbers at Belsen with the special difficulties of different races and languages and the uniform terror of torture at any unknown form of treatment. It was also proved that there were certain sections which were previously unsuspected. Further, the great majority of cases of advanced starvation can be brought through the short period of danger by simpler measures. But it remains probable that the development of the method will be found of value, possibly in conditions other than advanced starvation. The group of speakers included those who had been the earliest to enter Belsen who described the shock of the unexpected discovery and the initial desperate efforts to deal with the gigantic scale of the horrors.

The final meeting of July 9, 1945, was devoted to reviews of progress made in war medicine and surgery since 1939 and of lessons which experience had taught.

A few of the subjects may be mentioned in which one notes development as the war progressed. The organization of field surgical units and the reorganization of the British Field Ambulance, necessitated by the great distances in the North African desert, were applicable without great change to the conditions in Europe. One noted progressively the great development of blood transfusion, improved methods of resuscitation and transport of casualties (the essential factors in the low death-rate of wounded), the advance of suppressive treatment for malaria and inoculation against typhus, the prominence of psychological methods of selection of personnel and the ever closer cooperation of the medical services on land, sea and air. But I would like to add the cry heard again and again from medical officers of all services who took part in first landings, for more and more and yet more planes of Paris.

It was generally agreed that the Conferences had been successful in their object, enabling officers who were in the process of training to hear at first hand the organization and experiences of campaign battles, invasions, landings, raids and warfare on sea, land and in the air, the treatment of sickness and wounds, and by no means least, to learn the essential importance of hygiene and preventive medicine.

The Conferences further had the advantage of bringing together officers of all ranks of all the medical services of the Allies. The Royal Society of Medicine made a custom of giving an informal dinner, necessarily very limited in numbers, after each conference, especially to those who had been speakers. Many friendships were made at these gatherings.

The Conferences were held strictly under security. No references or notices were published in the Press, medical or otherwise and no minutes were kept. But as the Conferences drew to a close many wishes were expressed that it might be possible to publish a volume of communications. In response to this desire the Royal Society of Medicine undertook to make an attempt to collect material. The total number of the principal speakers at the Conferences was about 220. Some speakers had kept no record of their communications. Some others it has been impossible to trace, especially among those from the U.S. and Canadian armies in spite of every assistance from the respective Headquarters, and much personal assistance from Colonel W. S. Middleton, formerly Chief Consultant in Medicine, U.S. Army. Some of these officers are still probably in the Pacific and others have started medical practice in new districts. In spite of the difficulties over 120 MSS. have been received and thanks are due to the contributors who have made this volume possible.

The speakers came from both sides of the Atlantic and also from other countries, and in consequence there are differences in spelling and phrasing. No attempt has been made to reduce these to uniformity. The speakers were dealing with incidents still fresh in their memories and with events which had often left a great impression. For these reasons as few alterations as possible have been made in the MSS.

I shall undoubtedly be acting in accordance with the wishes of those who took part in or attended the Conferences in thanking the Council of the Royal Society of Medicine for granting facilities for the meetings. Special thanks are due to Mr. Geoffrey Edwards, the Secretary of the Society on whom fell the main burden of organization. Also to Miss M. M. Wheeler, the Assistant Secretary and her clerical staff for whom the meetings involved extra duties at a time when their numbers were depleted by calls to the Services, and to Mr. J. Cooper the Head Porter at the House for so many years.

Finally may I say that I regard it as a great privilege to have acted as President at the Conferences.

HENRY TIDY





# TEXTBOOK ADMINISTRATION OF MEDICAL SERVICES IN A DIVISION

MAJOR-GENERAL J. C. DOWSE, C.B., C.B.E., M.C.

*Inspector of Medical Services*

Whilst it is perfectly true that the basic principles of the art of war have not altered throughout the ages, the methods by which those principles have been put into practice have altered with each succeeding war and indeed constantly change during the conduct of any war.

I shall give you an outline of the chain of responsibility and the formation of the main elements of the medical organization of a division as we see it to-day. In order to portray a connected story, I must needs stray into the organization of the corps, for the two are interdependent.

I will for the sake of clearness, confine my remarks to the infantry division as distinct from the armoured because the principles involved from the medical point of view in handling the infantry division in comparison with the armoured are the same, the differences being largely those of degree and the speed with which the armoured division works and the large area of ground which it covers.

The G.O. commanding a division is responsible for everything that goes on in his division. He is therefore responsible for the efficiency of his medical services. To advise him on medical matters he has an Assistant Director of Medical Services (A.D.M.S.) who is a Colonel with a Major D.A.D.M.S. as his assistant. They form the medical staff of the division. The A.D.M.S. also commands the medical units in the division.

The entire medical services come under the Adjutant General's branch of the Army staff and the A.D.M.S. deals with that branch of the staff through the person of the Assistant Adjutant and Quarter-master-General, the A.A. & Q.M.G. and if he abides slavishly to the textbook he must receive his instructions as to the commander's intentions through that branch of the staff.

In war however the medical staff of a division has two distinct functions. One function is administrative, in which the A.D.M.S. looks after the arrangements for care of the sick and wounded, the maintenance of the health of the troops and the general sanitary requirements of the division. For the latter purpose he has a highly trained, if small, mobile hygiene section to assist him. The other role is operational, and as the A.D.M.S. commands the medical units in the division, it follows that he has to deploy those units in accordance with the commander's plan and issue the necessary orders in exactly the same manner as any

other commanding officer in the division, such as the Commander, Royal Artillery

Before any orders can be issued a commanding officer must know the plan of action. Therefore the A D M S must receive information as soon as any other commanding officer. This implies that he must take his part and place in the forward headquarters of the division so that he can be in on the game from the commencement, in other words, to complete his 'G' or operational function he must have very close liaison with the operational branch of the staff.

A story of what actually occurred in France before the evacuation may help to illustrate this side of the duties of the A D M S.

On May 25, 1940, my division was fighting in the region of the Forêt de Nieppe. I had recently joined the division and found that it was the rule for the A D M S to have his office at rear divisional headquarters. Rear divisional H Q. had been for three days at Quesne sur Deule, south of Comines, whilst the advanced H Q., with all the important portions of the staff, was at École de Steinje, some 28 kilometres further north and west. As A D M S I found that being so far away from the battle H Q. I was completely out of the picture.

I saw the divisional commander and, although our conversation was at first a little confused, he finally saw my point and I joined up with advanced H Q. This situation arose from the fact that the staff in those days did not appear to realize that the medical services had this operational role and, in the real stress of battle, it was well-nigh impossible for the A A. & Q M G. to keep me adequately informed of all the rapid changes in our front line which necessitated the constant ancillary and operational alterations in the positions of the medical units.

In battle the A D M S must be able to have *first-hand* information of all that goes on, only then can he control his medical units to the advantage of the wounded man and the satisfaction of his divisional commander. This information is best obtained from the 'G' staff. I am glad to say that the principle of recognizing the operational role of the medical services in war is now an accepted fact in 'Staff' circles.

Before I come to the actual formation of the medical units in a division it will be as well to recognize the essential facts which have led to the re-formation of the medical units as we see them to-day.

The British Army has had to fight in every climate, over varied terrain and in all types of warfare, and in all these conditions the Royal Army Medical Corps had to collect, evacuate and treat the sick and wounded of the Army and generally live up to its motto *In arduis fidelis*. The problem of producing a unit or a series of medical units which will answer the demands of all the varying requirements is an order of the first magnitude.

Let us therefore look for a moment at the process of evolution of our medical units.

In the South African war we experienced a mobile war carried out in

a country which permitted wide sweeping movements leading up to an assault on the enemy, here our forward medical units were composed of a bearer company which moved with the troops and collected the casualties, and of a field hospital that could treat the cases and hold them for a little before they were evacuated to the base hospitals.

Following the South African war came the Great War with an entirely different set of circumstances in that war the bearer companies and the field hospital were joined into one unit, which was called a field ambulance, while behind the field ambulances came a semi movable but a more or less static medical unit, the casualty clearing station (C.C.S.) (As its name implies the C.C.S. was to be used as a clearing and evacuating unit and was not intended to retain casualties for longer than was absolutely necessary.) This combination of units was eminently suitable for the type of fighting that was most common in the last war where armies faced each other for long periods across a 'No Man's Land' that might be anything from a few feet to many hundreds of yards wide.

The C.C.S. grew and grew in the war of 1914-18 till it became a very clumsy and heavy unit, in fact it ceased to be a mobile unit in any way. This defect was not really felt until the great advance in August, 1918 when we found that the C.C.S. could not keep pace with the advancing armies and had to be left behind, with the result that little or no surgery could be done for the wounded for a long time as the C.C.S. was the first medical unit in which serious surgery could be attempted under the conditions existing in those days.

Thus at the commencement of the present war we found ourselves, in September 1939 with exactly the same medical organization in the forward area as we had in November 1918 except that the horse had been replaced by the petrol engine in the unit transport. The A.D.M.S. had three field ambulances and a hygiene section as his medical units and the D.D.M.S. Corps one field ambulance, a hygiene section and a motor ambulance convoy, there were also three C.C.S. per corps which, although they were Army troops, were frequently administered by the D.D.M.S. of the corps in which they were located.

Some time before this war commenced students of the problems concerning the formation of the forward medical units realized that the organization that existed in 1918 would not answer many of the questions which modern developments seemed to suggest, but it was not until we were actually involved in war ourselves that the necessity for falling into line with modern requirements was forced home.

As a result of the experiences gained in the Spanish Civil War in the all too short period of fighting in France and Belgium and in the more prolonged but somewhat abnormal fighting in the Libyan desert, it was proved that the old textbook formation and handling of the medical units in the field was archaic and out of date.

Amongst the lessons learnt were that the A.D.M.S., in addition to his administrative duties has an operational role to perform, the field am

bulances were clumsy, relatively immobile, lacked adequate facilities for the carriage of the wounded and for intercommunication, and above all the C C S, the Army's most forward surgical centre, was very often too far from the fighting line to render adequate surgical aid to the wounded man and in any case was a very heavy and comparatively immobile unit, requiring some 52 lorries to move it from place to place.

The Director-General of the Army Medical Services therefore formed a committee to inquire into these matters and to make suggestions to remedy the deficiencies.

The committee was, in fact, to make suggestions which, if implemented, would improve the organization of the forward medical units as far back as railhead and bring them into keeping with modern requirements, *but* the committee must not ask for more doctors, there must be no increase in the quantity of transport demanded, and if there was a demand for an increase in personnel it would need to be very well substantiated.

However, the committee, in spite of terms of reference of such a devastating nature, produced results which have been accepted and are being implemented.

Before placing the deliberations of the committee on record, the Director-General sent me out to the Middle East to find out if the suggestions made by the committee – admittedly as the result of personal experience and the digest of numerous reports but still the emanations of the minds of a committee, as they sat round the council table – were, in fact, likely to answer the problems in the hard light of war.

It was encouraging to find that practically every suggestion met with the approval of the 'man on the spot'. Through force of circumstances, the medical directorate in the Middle East had already commenced to reorganize the forward medical units on lines so similar to the suggestions of the committee that the only differences were those caused by the peculiar terrain.

Put briefly, the reorganization consisted in making the field ambulance somewhat lighter both in personnel and equipment, increasing however its patient-carrying capacity by adding more ambulance cars to the transport. The H Q. of the field ambulance was to form an advanced dressing station (A D S) and the companies with their subdivisions into sections were to do the actual collecting of casualties. The advanced dressing station must of necessity be highly mobile and should not be asked to give more than very rapid first-aid, for it can rarely find time for complicated surgical procedures.

Thus there was a need for a unit inside the divisional area, which could undertake the resuscitation of the really badly shocked case and retain that case for a little time. To meet this need a new unit was devised called a field dressing station, well equipped with all that is necessary for the giving of blood transfusions and with personnel trained in that art, combining the duties of resuscitation

with those of collecting the casualties from the surrounding units.

In order to meet the demand for surgery as close to the fighting as possible, field dressing stations were also placed in the corps area and another new unit, a field surgical unit, produced. This is a highly mobile little unit with a surgeon and anaesthetist and full surgical equipment.

The field surgical unit when married to the field dressing station produces an advanced surgical centre, capable of looking after the surgery for really urgent cases. It answers the cry of the surgeon. Give me my cases early, as it is placed well up in the axis of advance of the corps and is as near the fighting as the tactical situation will permit, thus reversing the old process by bringing the surgeon to his casualty, rather than the casualty to the surgeon.

Behind the advanced surgical centres are placed two C.C.S.s. These units are also modified and made lighter and more mobile so that they can keep up with the rapidly moving front.

The lightly wounded man and the less urgent lying case is sent to the C.C.S., leaving the advanced surgical centre free to attend to the more serious case, in order that life and limb may be saved.

When these revised units came to be sorted out, it was realized that they were all expected to be very mobile and since mobility and post-operative treatment are not compatible, to round off the arrangements a 200-bed general hospital had been moved up to railhead there to act as a semi-static hospital for the reception of casualties pending evacuation.

There is some disagreement amongst the pundits on the vexed question of when and when not to give blood transfusions and who is to decide when such a procedure is necessary. Whatever the final decision, the Army Medical Service is well equipped by having a series of blood transfusion units available for attachment to the advanced surgical centres, or C.C.S.s, as well as the facilities already provided in the field dressing stations in the division.

To combat another serious defect in the old administration, the Motor Ambulance Convoy (M.A.C.), formerly a medical unit, now becomes a Royal Army Service Corps (R.A.S.C.) unit commanded by an officer of that corps. It has been enlarged and has 90 ambulance cars or buses in place of the 75 vehicles in the old unit.

A change has also been made in the operational function of the M.A.C. it is administered by the R.A.S.C. but operationally it comes under the D.D.M.S. of the corps or Army and now clears casualties from the A.D.S. inside the brigade area. In the last war M.A.C. cars did not come further into the divisional area than the main dressing station (M.D.S.). By carrying casualties directly from the A.D.S. to the appropriate medical unit in the corps area it avoids one of the complaints of the older administration whereby a wounded man was moved from car to car perhaps three times before he reached

the place in which he was, at last, to receive adequate treatment

This method implies that *triage*, or the sorting and disposal of casualties to suitable medical units in the corps, is performed in the A D S and not, as in the last war, in the M D S (which really no longer exists)

Triage therefore becomes one of the most important features of the forward medical policy. Casualties are divided into three main groups: Group (1), cases which require immediate resuscitation, and are dealt with inside the divisional area, Group (2), cases which require urgent surgery, mainly to save life and limb, and are sent to the advanced surgical centre in the ambulance cars of the M A C (the acute abdomen and the severe fracture, etc., will find themselves here), Group (3), cases which comprise the non-urgent lying case, the walking wounded, some, if not all, of the head cases, the facio-maxillary and the sick, these are sent to the C C S by the cars of the M A C directly from the A D S. Buses have been added to the M A C for the carriage of the walking cases.

When the personnel to equip these new units came to be discussed it was at once apparent that one of the strictest of the terms of reference could not be carried out if the committee's suggestions were put forward, since it was absolutely impossible to build adequate units without asking for more officers.

However, it had long been recognized, though only contemplated as a last resort, that certain duties in the forward medical units might, without any great loss of efficiency, be performed by non-medical officers.

Accordingly a new type of officer in the R A M C was suggested, to be known as the non-medical officer R A M C. The main function of such an officer was to undertake duties in the field ambulances, field dressing stations and casualty clearing stations, which did not require medical knowledge of the standard of the fully qualified doctor, but which did want a high standard in the qualities of man-leadership and a considerable expertness in advanced first aid.

An officer with these qualifications would command one of the sections of the field ambulance and do the work formerly done by the 'Bearer Officer'. In the field dressing station he would be the company officer and officer in charge of evacuation, etc., in the C C S he would perform similar duties.

The selection of these officers has already been made, the preliminary training is in the process of commencing, and they should be available for duty in the early months of next year. By the introduction of this type of officer the obstacle to the implementation of the committee's suggestions has been overcome, and though I personally do not maintain that any non-medical man can be as good as a qualified doctor in the R A M C, there are obvious occasions where six years' study to become a doctor is not of necessity the hallmark of a good 'Bearer Officer'.

This new organization will alter the medical administration problems to some degree

The D D M.S. of a corps was formerly very largely the postmaster of a post office for returns and had very little operational work to perform. He now becomes a most important link in the evacuation system of the medical services and will have a fine job in organizing the surgery in the corps area and seeing that the various units that he controls are placed to the best advantage of his corps.

The duties of the A D M.S. will not be greatly altered. He is still responsible for the collection of all the casualties in his division and for the general medical supervision of the troops in that division.

His function as the organizer for the prevention of loss of man power through a well organized medical service has as much effect on the final winning of the war as his divisional commander himself in bringing a battle to a victorious conclusion.

POST SCRIPTUM (July 1945) — In the light of the further experiences of three more years of war modifications have been made in the re-organization as outlined but the principles remain. Though still in its infancy air lift for wounded plays a very important part in our modern conceptions of how the casualty should be most adequately dealt with.

JANUARY 1943

## ROYAL AIR FORCE MEDICAL ORGANIZATION

AIR MARSHAL SIR HAROLD E. WHITTINGHAM K.C.B. K.B.E. K.M.P.

*Director-General of Medical Services, P.A.F.*

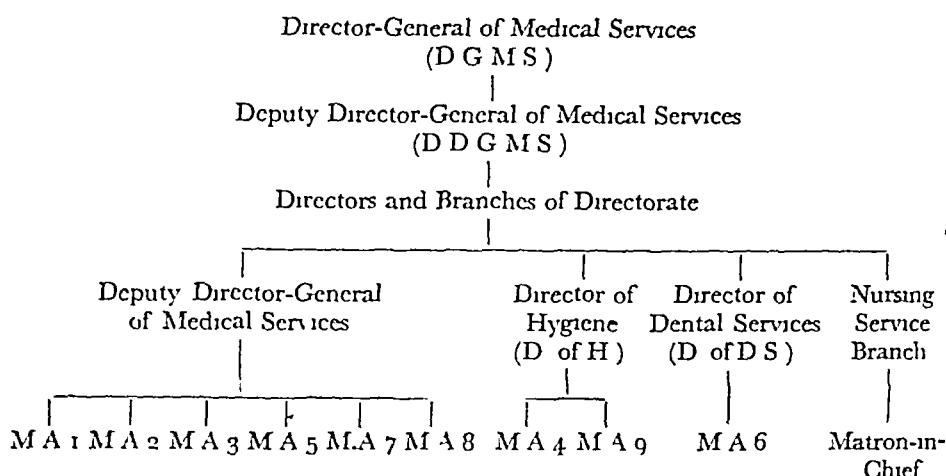
The Royal Air Force Medical Service is separate from those of the Navy and Army but close collaboration exists between them and the Emergency Medical Service in the matters of hospital provision, supply of medical equipment and evacuation of casualties. The medical requirements of the Fleet Air Arm are under the control of the Medical Director-General of the Navy. Questions of medical policy common to all Services, such as new hospitals, training, medical stores and economics are dealt with by joint Medical Services Committees.

The Air Council, consisting of 12 members, 6 civil and 6 Service, is the supreme authority of the Royal Air Force. The Director-General of Medical Services, who is not a member of the Council, can be called upon when special medical matters are under consideration. Medical interests generally are the responsibility of the Air Member for Personnel.

The Medical Department of the Air Ministry has at its head a Director-General of Medical Services and under him there is a staff responsible



for the complete administration, organization and direction of all medical, dental and nursing problems which affect the Royal Air Force. There are 9 main branches of the Directorate, which may be illustrated by the plan below



MA 1 deals with personnel, their entry, training, posting, reports and promotions

MA 2 deals with professional medicine, including medical standards, medical boards, provision of hospitals, treatment in hospitals and sick quarters, and general arrangements for the sick and wounded, including transportation of casualties

MA 3 is responsible for the supply of medical equipment and of barrack stores for medical units

MA 4 over which there is a director of hygiene, deals with preventive medicine in general (including building planning), gas warfare, and research

MA 5 is concerned with civil aviation, dealing mainly with medical standards, medical examination and medical equipment

MA 6 under the director of dental services, controls the dental branch

MA 7 is responsible for medical statistics, including the compilation of health reports

MA 8 compiles the Medical History of the War

MA 9 deals with the medical aspects of the selection of personnel for air crew duty, synthetic training and the human factor in the causation of flying accidents

There are two other branches

Woman Medical Liaison Officer who deals with questions peculiar to the Women's Auxiliary Air Force

Nursing Service Branch which deals with all administration and organization of the Princess Mary's Royal Air Force Nursing Service

The Director-General of Medical Services controls research through the medium of the Flying Personnel Research Committee, which consists of a chairman and eight members representing the various specialities. Five other establishments are also controlled directly by the Director-General of Medical Services, namely the Central Medical Establishment, the Medical Training Establishment and Depot, the Institute of Pathology and Tropical Medicine, the Medical Statistical Office, and the Medical Stores Depot. In addition, there is a Medical Advisory Board to advise the Director-General of Medical Services

on any matter affecting the health of the Royal Air Force that he may lay before them

*The Central Medical Establishment* bears on its strength the 21 consultants all of whom have direct access to the Director-General of Medical Services as advisers most of the consultants are seen by the Director General of Medical Services once a week. The Central Medical Establishment organizes and administers two main Invaliding Boards, which deal with the final discharges of officers and any case which cannot properly be dealt with by hospital boards. Twelve Aviation Candidates Medical Boards are also under the control of the Central Medical Establishment they are scattered throughout the United Kingdom engaged on the special medical examination of prospective members of aircrew Other units and services are also administered by the Central Medical Establishment namely the Aircrew Disposal Unit which keeps track of all Air Force casualties in other Service and civil hospitals and arranges for their expeditious transfer to appropriate Royal Air Force hospitals to ensure prompt return to duty mass radiography for which purpose five units exist two dealing with aircrew, two with ground duties personnel, and one with entrants to the Women's Auxiliary Air Force the Blood Transfusion Team and the Physiology Laboratory

*The Medical Training Establishment and Depot* is the unit at which all medical officers, male and female and medical airmen and our women receive their initial training It has an organization for the continuation of training in the various hospitals and large sick quarters throughout the country

*The Institute of Pathology and Tropical Medicine* is the unit where medical officers and airmen are instructed in pathology and tropical diseases, and is also the Central Pathological Laboratory of the Royal Air Force.

*The Royal Air Force Commands* are organized on a functional basis at present there are fifteen, nine at home and six abroad Each command has a principal medical officer (P M O) and an adequate medical staff which includes an inspecting dental officer The main members of the staff are shown below

D.P.M.O.	Group Captain.
D.P.M.O. (Hygiene)	Group Captain or Wing Commander
D.P.M.O. (Flying)	Wing Commander
D.P.M.O. (Woman)	Squadron Leader
Inspecting Dental Officer	Group Captain or Wing Commander

Medical officers must work in close liaison with their commands and understand their problems if they are to carry out preventive medicine properly The area of administration of Royal Air Force Commands at home covers the whole of the country and all the outer isles including the Shetlands the sphere of Coastal Command is even larger stretching from Iceland to Gibraltar It is therefore essential to place

senior medical officers, in the rank of group captain or wing commander, in charge of subdivisions of the commands, called groups. The number of groups in each command varies from two to ten, and each group administers stations which vary in number from four to thirty-two according to the function of the group. Stations hold a number of units, between two and six, which in an operational command are called squadrons. Stations within groups are provided with a senior medical officer of the rank of squadron leader and each large unit or squadron has a squadron medical officer to provide that continuity of contact so necessary between the medical officer and flying personnel.

*Hospitals* are provided to meet the special needs of the Royal Air Force, though full use is made of naval, military and civil hospitals whenever possible. Most of the R A F hospitals are general hospitals with special departments for orthopædics, burns, neuropsychiatry and diseases of women.

At home there are fourteen neuropsychiatry centres, six in operational areas and eight in non-operational areas, there are four burns centres, four plastic and facio-maxillary centres and sixteen centres for diseases of women. There are eight orthopædic centres in England and Wales and four rehabilitation centres. In Scotland, by arrangement with the Scottish Office, there are three hospital centres where Royal Air Force sick are congregated.

Hospital beds are provided at home on the basis of 1.5% of strength, and the staff, including administrative personnel, is established as follows: one medical officer to 25 beds, one nursing officer to 10 beds; one nursing orderly to 10 beds and one aircraft hand to 10 beds.

*Sick Quarters* are established at all Royal Air Force Units, however small, the bed provision is 1% of strength of Royal Air Force and 2% of strength of Women's Auxiliary Air Force. Most of these sick quarters may be compared with small cottage hospitals and are capable of dealing with minor and emergency surgery. They are so fitted as to be able to treat and hold casualties during enemy attack.

Each unit of any size has a well-equipped dental surgery, small scattered units are visited periodically by mobile dental caravans.

JANUARY 1943

## DISPOSAL OF CASUALTIES DURING AND AFTER A NAVAL ACTION

SURGEON COMMANDER J J KEEVIL, D.S.O., R.N.

*Medical Department Admiralty*

Naval experience between 1914 and 1918, although it involved much patrolling in the earlier years and much convoy work towards the end did not in fact include much contact with the enemy fleet except on certain occasions, which from the medical point of view differed little from naval actions over the centuries. The enemy is in sight his guns fire and your guns fire, after which there is a decent pause and casualties are collected and treated perhaps there is a chase, anyway the classic lull in action is provided, during which the medical party which has so far been carefully sheltered emerges and starts operating.

It was with this picture in mind that the naval medical service embarked on its new duties in September 1939. Through the long years of peace a new generation unfamiliar with war, had been trained in the tradition of its fathers and with a trusting heart had given its routine first aid lectures to a limited number of men had distributed a few first aid bags to certain traditional positions, had drilled one or two stretcher parties and had organized in all ships larger than a destroyer two medical action centres. These were not chosen for their accessibility or suitability in any way, but solely for the degree of protection they afforded, and this protection was considered only in terms of surface action that is side armour and not in relation either to torpedo mine or bombing attack.

The first notable action of the war was on December 13 1939 and it was unfortunate that the battle of the River Plate was a surface action and in no way characteristic of future enemy attacks. The medical arrangements were found on the whole to be satisfactory and so no drastic change was made in them. But already there was some loss of conviction in certain quarters. After the first bombing attack on H.M. ships in home waters on October 15 1939 doubts were expressed as to the adequacy of the arrangements to meet this new form of attack. Then came numerous isolated experiences from ships that were mined, then the more concentrated bombing of H.M. ships in Norway. The body of evidence grew steadily yet so thoroughly had medical officers been trained in the old organization and so gradual and cautious were the criticisms of it that it persisted till February 12 1941. Then came a basic change and in place of concentration of medical personnel and stores in two centres there was officially authorized a dispersal system. But even this was phrased

somewhat ambiguously and left much to local judgment, so that Crete still found the old system largely in force and it was still unhappily observed in a capital ship lost at the close of the year, when the whole of one medical centre, with 50% of the personnel, was wiped out. Happily the order was made more specific in October 1941, and is now widely in force. It was certainly none too soon.

The medical problems characteristic of this war are not those of Trafalgar, or Jutland, or the River Plate. One of the greatest differences is the variety and number of the wounds.

The shell fire of surface actions produces splinter wounds, lacerations and, very incidentally, some fractures. This was all that the medical officer of the last war had seriously to consider.

To-day by far the commonest form of attack is bombing, and the characteristic injury is flash burns, which occur in great numbers.

Casualties from mines were not an appreciable factor in previous wars, but in this war they have produced heavy casualty lists. These are so characteristic that the weapon can be deduced from them even were it not stated. The mortality is low, but the disabling sequelæ are great for all the casualties are fractures. Immediately above the explosion the men – generally stokers – have fractures of the os calcis. On the mess decks there are fractured femurs and legs, while on the upper deck there are compression fractures of the lumbar vertebræ and fractures of the base of the skull. As many as 70 such casualties have had to be dealt with in one ship, and involve not only experience and skill but constitute a great problem in equipment and nursing.

Casualties from torpedoes are fortunately very light, in most cases the mortality has been negligible and the injuries are a few contusions and possibly some fractures from men being knocked over.

But in both the last cases there are unexpected complicating factors. In the extremely severe explosions from mines a curious state of apathy and inertia is sometimes produced which impedes effective action, while the torpedo explosion is associated with the production of nitrous fumes and these may later cause serious pulmonary œdema. Moreover, the torpedo more commonly than other weapons involves the need for preparing to abandon ship.

It will be appreciated that not only has provision now to be made for a range of cases never seen in the past, but that, owing to the variety of weapons, there is no longer any part of the ship which can be regarded as especially safe for the care of the wounded. In my last ship, for example, the official position for one dressing station was far below the water-line and extremely vulnerable to both the torpedo, magnetic mine, and bombs exploding on the sea bed in shallow harbours. Had it flooded, escape would have been impossible. On the other hand a situation higher up was exposed to bombs exploding between decks.

Increasingly therefore the policy has been to seek places which afford medical and nursing advantages, and to disregard factors of safety.

any medical losses being compensated for by the policy of dispersal.

Another problem peculiar to this war is the enormously extended period of action especially from bombing attacks on certain convoy routes. This has rendered impracticable the time honoured precept that major surgery is not to be undertaken while action is in progress. In many cases it has been essential to embark on laparotomies and amputations and to give many anaesthetics even though attacks were continuing and the future held every prospect of having to abandon ship.

In fact, however abandoning ship has been much more rare relative to damage in this war than in the last, owing to the very great development in methods of controlling damage.

Medically this provides yet one more fresh problem, for whereas between 1914 and 1918 much damaged ships with heavy casualties sank and only the fit survived, in this war they do not sink and the severely wounded remain to be cared for under conditions of appalling difficulty. In H.M.S. *Exeter* after the River Plate the numerous wounded were on board for a period of five days, during which few could be spared to attend them as every man was needed for repair work.

This control of damage has very greatly interfered with communication and whereas this does not seriously affect other departments which can function by telephone, it greatly impedes the medical activities which are essentially mobile. It is a feat of considerable ingenuity to move a casualty in action when almost every door and hatch is closed and may involve ascending and descending many decks in order to reach a dressing station on the same level. In other cases portions of the ship may become completely isolated by fire and arrangements have to be made to pass cases over the side on floats or rafts.

Apart from any casualties sustained in the ship herself, she may receive some hundreds of survivors from other ships, all of whom are covered with oil fuel and suffering from shock and among whom it is difficult to distinguish the wounded from the uninjured. Such a situation is not improved by the realization that she may be the next ship to be sunk, as has happened in many cases. Under such circumstances much treatment must be left in the hands of volunteers from among the seamen and in general the treatment they give from their own judgment is good, but it has been found desirable to extend very greatly the instruction of first aid.

These are the immediate problems there remain the later ones of disposal. Hospital ships are not numerous and do not accompany the fleet in action, and in general one has to depend on the hospitals in the nearest suitable port. If this happens to be a neutral one, as in the case of Buenos Aires after the River Plate, then the question of internment of the wounded is a complicating factor which has to be considered and may sway the decision in favour of keeping them on board until an allied port can be reached.

Finally there is the case of the ship with no medical officer and with

wounded on board, a situation common on the convoy routes. Though much can be done by signalling instructions for treatment and by transferring medical supplies by such varied methods as firing them from a Costern gun or floating them over on a lifebuoy, yet, where possible, a medical officer is sent over in a boat. When conditions at sea do not admit of this, cases have been transferred instead to the ship with the medical officer, the other steaming on a parallel course and the patient being slung across either by means of a breeches buoy or placed in a stretcher and then hoisted across the gap between the ships by means of an aircraft crane.

FEBRUARY 1943

## AIR TRANSPORT OF CASUALTIES

AIR MARSHAL SIR HAROLD E. WHITTINGHAM, K.C.B., K.B.E., K.H.P.

*Director-General of Medical Services, R.A.F.*

*History* – Air ambulances have been in use in the R.A.F. since 1919, the machines used being Vickers Vimy, Vickers Vernon, Valentias Victorias, Air-Speed Oxfords, D.H. 86's and 89's. Troop-carrying aircraft, temporarily converted into air-ambulances, have also been used extensively, especially during expeditions and in the present war.

The following table shows the number of casualties evacuated by air during the years 1919-1942 inclusive, and it will be seen that from 1923-1940 there were between 66 and 418 cases evacuated by air each year, chiefly in Iraq, Palestine and India.

TRANSPORTATION OF CASUALTIES BY AIR BY THE ROYAL AIR FORCE

<i>Year</i>	<i>Numbers</i>	<i>Chief locality</i>
1919	3	Somaliland operation.
1920	—	Development of air ambulances
1921		
1922		
1923	359	198 during operations in Kurdistan
1924	81	Iraq
1925	176	Iraq
1926	130	Iraq
1927	125	Iraq and Palestine.
1928	86	Iraq and Palestine
1929	66	Iraq and Palestine
1930	91	Iraq
1931	125	104 in Iraq
1932	177	138 in Iraq
1933	188	159 in Iraq
1934	173	Iraq
1935	418	Iraq and India (Quetta earthquake)
1936	161	Iraq
1937	298	157 in Waziristan, 89 in Iraq
1938	149	70 in Iraq, 47 in Palestine, 22 in India, 10 in other commands

<i>Year</i>	<i>Members</i>	<i>Chief locality</i>
1939	128	74 to U.K. from France 45 in Middle East 9 in U.K.
1940	140	Mainly from France to U.K.
1941	1,996	Chiefly in Middle East War in Western Desert.
1942	10,000 approx.	Chiefly in Middle East War in Western Desert.

In 1941, the number of casualties evacuated by air was increased about ten fold, 1,996 being so transported, the majority being in the Middle East. It is interesting to note that -

- (i) stretcher to walking cases were in the proportion of 2 to 1
- (ii) battle casualties to disease were in the ratio of 3 to 1
- (iii) the proportion of Army personnel to R.A.F. was in the ratio of 8 to 1

The first definite organization of an air ambulance service in the United Kingdom was based on Halton during the years 1925-1926 to deal with cases over 100-mile radius. This service was little used owing to emergency cases being admitted to the nearest hospital, Service and civil and to the absence of air mindedness of the medical profession as a whole at that time.

However, in June 1941, a definite air ambulance organization, consisting of seven specially fitted aircraft marked with the Red Cross of Geneva, was established in this country. These ambulance aircraft were stationed at -

- (i) Hendon to deal with England and Wales, including the Isle of Man
- (ii) Abbotsinch near Paisley to deal with the West of Scotland the Western Isles and the North of Ireland
- (iii) Wick to deal with West and North Scotland the Orkneys and Shetland Islands.

At the same time, courses of instruction of a fortnight's duration were arranged for specially chosen nursing orderlies. They were given instruction in loading and unloading of aircraft as well as the preparation of the patient before transport. They made actual air journeys to accustom them to air travel. Recently, the course has been extended to three weeks.

We are now (1943) fitting out a number of aircraft to take 18 stretcher cases, as well as a medical officer or a nursing sister and two nursing orderlies, if required. There will be an oxygen supply for all personnel, sufficient for eight hours. These aircraft are well heated, ventilated and lighted, and are provided with an Elsan closet and a special medical pannier.

*Use of transport aircraft for evacuation of casualties* - Up to now (1943) owing to the urgent need of using every aircraft available for operational purposes, it has been the policy that aircraft should not be set aside in theatres of war for the sole purpose of conveying sick and wounded, as air ambulances tie up aircraft badly needed for the transport of troops and stores, as well as tying up personnel. It has been agreed, however,



that all transport aircraft should be so modified that they can be quickly converted for ambulance purposes to evacuate casualties on their return journeys after transporting personnel and equipment. Fitment for this conversion, to take standard Service stretchers, both British and U S A , will be carried on board each transport aircraft, so that they can be erected for ambulance use, or stowed away within ten minutes. These aircraft will not show the Red Cross of Geneva, but have to take their chance against enemy attack.

*Scheme of organization* - The present scheme is that a small mobile tented hospital (mobile field hospital) capable of accommodating 40-100 beds, and equipped for emergency medical and surgical treatment, will be placed on or near the airfield of departure in the field, so as to hold cases ready for immediate emplaning as required, the time for holding to be as short as possible, according to weather conditions and enemy attack. It will be the duty of the medical staff at these mobile field hospitals to ensure that patients are in a fit and suitable condition for air transport with the minimum of inconvenience to the patients. At the base a similar medical reception station will be provided on or near the airfield to hold the cases until they are fit to proceed on their journey by rail or road to convoy hospitals. Here they will be classified for transfer to special hospitals applicable to their injuries.

*Liaison* - The senior R A F medical officer at the Air Group Headquarters of the emplaning airfield must maintain the closest liaison with the field medical units and hospitals in the vicinity. He will obtain from these units the estimated number of casualties, whether stretcher or walking cases, and the nature and condition of each, as well as any special medical arrangements or equipment needed for any particular case during the flight. He will warn the various medical units of the approximate time of departure to ensure the minimum of wait and discomfort to the patients. He will also be responsible for the exchange of equipment necessary between airfield and aircraft, and airfield and hospital, such as stretchers, blankets, splints, etc.

*Preparation of casualties* - It is most important that patients should be prepared as fully as possible for the air journey, so that they will need the minimum of attention in transit. Wounds should be dressed and fractures set before emplaning, no one should be emplaned immediately after an operation or hæmorrhage; no case of shock should be moved until after recovery. A light meal with limited fluid should be given before emplaning, bowels and bladder should be emptied a short time before, and a sedative such as bromide, chloretone, hyoscine or morphia may be given to nervous patients or to those prone to travel sickness to help ensure a quiet journey and prevent air sickness. Patients should be as fully clothed as practicable to keep them warm; long stockings are most useful, and a hot-water bottle should be provided for each patient in temperate climes. Air rings are needed for some patients.

*Medical care en route* — As far as possible a medical attendant should accompany all casualties by air such attendants are usually specially trained nursing orderlies. They are required mainly to give comfort reassurance and nourishment or to deal with immediate wants, such as sickness, bed pans and give first aid or hypodermic injections or administer oxygen to patients as necessary. Members of aircrews should be trained to look after patients *en route* if required.

*Cases suitable for air transportation* — As only a small percentage of casualties can be evacuated by air particular care must be exercised in their selection. The senior Royal Air Force medical officer concerned is vested with the authority for the final selection of cases for evacuation by air the guiding principles for this selection being the rapid transfer of cases requiring special treatment to appropriate centres, especially where speed is likely to make all the difference between success and failure of treatment, and humanitarian considerations likely to affect the morale of the Forces.

*Cases suitable for air transportation in order of priority are —*

- (i) Facio-maxillary injuries.
- (ii) Burns after shock has been overcome.
- (iii) Perforated wounds of globe of eye, particularly those containing foreign bodies.
- (iv) Fractured limbs and joint injuries these must be efficiently immobilized.
- (v) Head injuries, but not if unconscious or if breathing is affected.
- (vi) Pelvic and spinal injuries, after encasing in plaster.
- (vii) Empyema, after aspiration.
- (viii) Tuberculosis of lung, but not if hæmoptysis present.

*Cases suitable for air travel* are those suffering from:—

- (i) Shock.
- (ii) Recent abdominal and thoracic wounds.
- (iii) Acute abdominal conditions.
- (iv) Recent severe hæmorrhage including hæmoptysis and hæmatemesis.
- (v) Gas gangrene.
- (vi) Poisonous gases.
- (vii) Lobar pneumonia or pneumothorax.
- (viii) Angina pectoris or coronary occlusion, during first month of condition.

*Notification of patients arrival in the United Kingdom.*—The Commanding Officer of the R.A.F. station at which the aircraft arrives in the United Kingdom will notify Movements 5 at Air Ministry by important signal, of the following details regarding each patient transported —

- (a) Number, rank, name and initials.
- (b) Unit and Service (Navy, Army or Air Force).
- (c) Date and time of embarking.
- (d) Date and time of disembarking.
- (e) Hospital to which sent.
- (f) Disability.

Movements 5 will pass by signal this information to A.M.D. 12 at the War Office, who will in turn notify the appropriate department. Arrangements for notification on similar lines will be made for Overseas Commands.

*First-aid equipment and barrack equipment.* — First-aid equipment consists mainly of morphia, cardiac stimulants, antiseptics and anti-burn jelly. In the tropics and sub-tropics the outfit includes drugs suitable for treating malaria, dysentery and snake bites, accompanied by a pamphlet describing in simple terms how to avoid tropical infections at stopping places *en route*. Six Thomas's splints are carried in each aircraft for exchange at the airfield for those fitted to patients. This procedure will help to ensure that the proper complement of splints is maintained in the theatre of operations. Barrack equipment includes thermos flasks for coffee or tea, water bottles, bed pans, urinals, and vomit bag.

*Responsibility for evacuation of casualties by air.* — The evacuation of casualties by air in any field of operation is entirely the responsibility of the Royal Air Force, from admission to the Casualty Air Evacuation Unit or air strip of departure until disembarking and dispatch from the airfield of arrival.

MARCH 1943

## RATIONS FOR THE ARMY IN THE FIELD

MAJOR IAN A. ANDERSON, R.A.M.C.

The all-important task of feeding the soldier falls on the Supply Services. But the Medical Services, acting in an advisory capacity, are responsible that the rations provided have the best possible nutritive value for the various climatic conditions in which the soldier has to serve, and for activities which vary from garrison duty in some base area to commando or airborne operations.

This brief description of the various rations used in the British Army will deal more with the nutritive than the supply aspect.

*Field service ration scales.* — A basic field service ration scale is drawn up for each theatre of war. Each scale consists of two parts: —

1. The fresh ration scale, where perishable foodstuffs are issued in fresh form;
2. The tinned equivalent scale, where perishable items are issued in processed form (canned or dehydrated) — used only when operational conditions prevent the distribution of fresh foodstuffs.

In both scales alternatives are included for several of the items to give variety to the ration and allow an adequate ration to be issued in spite of temporary fluctuations in food stocks.

Table I shows the nutritive value of two typical field service scales as compared with the optimum dietary standards laid down by the U.S. National Research Council, against which all Army ration scales are assessed. The chief point brought out by the table is that the protein, energy and mineral requirements are met, but the content of

some of the vitamins, particularly riboflavin and vitamins B<sub>1</sub> and C in the tinned scales, falls short of the optimum requirements. Restrictions imposed by the world food situation on the provision of generous amounts of riboflavin-rich foods and the partial destruction of vitamins B<sub>1</sub> and C in the preparation of the processed foods of the tinned ration scale explain why a less than ideal content of these vitamins in rations has had to be accepted. Fortunately we are able to increase the intake of these vitamins where required by the use of concentrates.

Incidentally the only noteworthy instance of outspoken vitamin deficiency disease among British troops has been in Gambia. Here the already low riboflavin content of the ration scale was further restricted by shipping losses which often prevented the issue of valuable foods like cheese and yeast extract. As a result, the mouth and tongue lesions of riboflavin deficiency were at one time found in as many as 14% of European personnel in some parts of Gambia. Special measures have now been taken such as the inclusion of skim milk powder, ground nuts, and yeast in the scale and the use of vitamin supplements.

There were, too, in the past a few isolated instances of beri beri among men of the Long Range Desert Group who operated for weeks on end behind the enemy lines and had of necessity to exist on tinned rations. The use of vitamin B<sub>1</sub> supplements by such troops was then enforced.

*Vitamin supplementation of Army rations* - Under certain circumstances such as those mentioned above, Army rations must be supplemented with vitamin concentrates. There are four of these in use at the moment -

- (i) Vitaminized chocolate. Chocolate figures in all field service ration scales and is also an important constituent of several special ration packs for particular conditions. All the chocolate included in Army rations is now being fortified so that 1 oz. contains approximately 1 500 i.u. vitamin A, 250 i.u. vitamin B<sub>1</sub> and 20 mg. vitamin C.
- (ii) Tablets of a special dried yeast rich in vitamin B<sub>1</sub>, each tablet containing almost 100 i.u. of the vitamin.
- (iii) The yeast extract known in this country as marmite. Although its vitamin B<sub>1</sub> content decreases rapidly on storage it is a valuable source of vitamins of the B complex.
- (iv) The fourth supplement is ascorbic acid, 25 mg. tablets of which have been an Army issue since the days of the B.E.F. in France in 1939-40.

*Special rations* - Mobile warfare and special operations like opposed beach landings, commando raids, and airborne attacks produce conditions where the normal field service ration cannot be issued, and special ration packs have had to be devised to meet such situations.

*The mess tin ration*. - This ration had to -

- (i) be capable of being carried by the individual soldier fitted into two halves of the Army mess tin,
- (ii) supply enough food for a period of forty-eight hours,
- (iii) be capable of being eaten without cooking, apart from the boiling of water to make tea,
- (iv) be proof against damage by water or poison gas,
- (v) be capable of withstanding storage over a considerable period, as the operations for which it was designed might well be staged at short notice

Details of the mess tin ration, designed to meet the above conditions, are shown in Table II. It was used as a landing ration in both North Africa and Madagascar, and comments from both places were favourable. In field trials in this country, however, it has been shown that about 25% of men find its low calorie value (2,560 calories per day) inadequate to satisfy hunger. It is a moot point whether this deficiency in energy value is great enough to impair military efficiency, but a new mess tin ration is at present being devised, which will contain special biscuits rich in fat and blocks of pre-cooked, ready to eat, dehydrated foodstuffs, and will have a considerably greater energy value.

*The composite ration pack* – The mess-tin ration<sup>1</sup> was designed to cover the first forty-eight hours of an operation such as an opposed beach landing. After this time there is a period, which may extend into weeks, before port facilities and depots for storing and breaking down bulk supplies of food are available. For obvious reasons, it would be highly undesirable to feed men for weeks on end on the mess-tin ration. The need during this period of the 'build-up' is for a ration that will meet the nutritive requirements in full, but is at the same time capable of withstanding prolonged storage, and is ready packed in units suitable for rapid handling and distribution to small bodies of men. In addition, the ration must require no more cooking than is involved in the boiling of water, since proper cookhouses and centralized messing are obviously impossible in the days following a beach landing. Finally, the ration must provide variety, for troops cannot be expected to relish having to exist for weeks on end on the same ration.

To meet this need, the composite ration pack was designed. This is, in brief, a wooden case containing sufficient tinned foods to provide four meals a day for fourteen men. The tinned foods consist of pre-cooked items that only require standing in boiling water in the opened tins in order to produce appetising dishes – at a pinch, they can be eaten cold.

Table III shows the contents of the pack, arranged in the form of meals according to the instructions provided in each pack. By various combinations of the items shown as alternatives, packs with nine different menus have been produced to provide the necessary variety. The nutritive requirements are also met even for prolonged use of the packs.

The composite ration pack was the sole ration issued for several

weeks after the North African landings, and reports have been uniformly enthusiastic.

*The arctic pack* - The possibility of mobile warfare under arctic or sub-arctic conditions has made it necessary to produce an individual pack which could be carried by men operating in small bodies such as sledge parties. The experience of polar explorers and of the last war showed that a ration of as high as 5 000 calories per day would probably be required. In order to keep bulk and weight to a minimum a special ration was designed containing foods with a high caloric/weight ratio and packed as a unit sufficient for two men for one day. The contents of the pack and its nutritive value are shown in Table IV. The nutrients are all present in adequate amounts except for vitamin B<sub>1</sub>, of which there is less than the usually accepted minimum requirement for health viz 10 i.u. per 100 calories. Arrangements have therefore been made that three high vitamin B<sub>1</sub> yeast tablets per man per day will be issued along with the arctic pack.

A practical disadvantage of this ration lies in the number of tins that have to be opened with gloved hands and in conditions of extreme cold.

*The armoured fighting vehicle pack* - In action, tank crews may have to be self-sufficient as regards food and water for a day or more at a time. Tanks are therefore provided with metal food containers, and three sizes of a one-day pack of processed foods in a cardboard container have been prepared, sufficient for one day for two, three, and five men respectively. Three days allowance of these packs for the crew can be stored in the metal food container of a tank, and this allowance is carried in all tanks to act as a reserve in cases where crews cannot be fed on the ordinary ration.

Table V shows the contents and nutritive value of the two-man size of pack. The packs have been criticized on the grounds of monotony. Although this is not so important in a ration that is to be used only in an emergency and for a maximum of three days on end, this criticism is being met by the introduction of three packs with different menus for each of the three sizes of pack.

TABLE I—NUTRITIVE VALUE OF TYPICAL ACTIVE SERVICE RATION SCALES

Nutrient	Temperate climates		Middle East		Optimum daily requirements of an active man
	Fresh	Tinned	Fresh	Tinned	
1. Protein - gm.	112	132	100	178	70
2. Fat - gm.	171	150	170	196	
3. Carbohydrate - gm.	445	468	476	486	
4. Calories	3710	3760	3770	3890	3600 & upwards
5. Calcium - mg	830	820	700	760	800
6. Vitamin A (Lu.)	2630	2490	2600	2250	3000*
Vitamin B <sub>1</sub> (Lu.)	670	490	630	500	700
8. Riboflavin - mg	1.4	1.9	1.2	1.5	2.7-3.3
9. Nicotinic acid - mg	28	29	26	33	18-23
10. Ascorbic acid - mg	70	22	130	70	75

\*As units of preformed vitamin A.

TABLE II - THE MESS TIN RATION

<i>Item</i>	<i>Quantity for 48 hours oz</i>	<i>Packing</i>
A Items contained in a single airtight tin, which fits into the smaller half of the mess tin and is provided with a key opener -		
1 Service biscuit standard	9	In paper package
2 Service biscuit sweet	3	In paper package
3 Raisin chocolate	8	In four 2 oz slabs
4 Barley sugar sweets	4	Paper wrapped
B Items packed separately into the larger half of the mess tin -		
5 Preserved meat	12	In a tin with key opener
6 Cheese	3	In two circular 1½ oz tins
7 Beef dripping spread	2	In a circular tin
8 Tea, sugar, milk powder	5	In a vacuumized tin sufficient for 6 pints of tea
9 Matches	One small box	
A small circular tin cooker filled with solid fuel is carried in the pocket.		

## NUTRITIVE VALUE PER 24 HOURS

Protein	74 gm	Carbohydrate	286 gm
Fat	116 gm	Calories	2560 gm

TABLE III - COMPOSITE RATION PACK

<i>Meal</i>	<i>Item</i>
1 Contents -	
(a) Items common to more than one meal	1 Biscuits 2 Margarine 3 Tea, sugar, milk powder
(b) Breakfast	4 Sausage, or bacon, or spam
(c) Dinner	5 Steak and kidney pudding, or stewed steak, or haricot oxtail, or preserved meat, or Irish stew, or meat and vegetable ration 6 Vegetables 7 Steamed pudding (six varieties) or tinned fruit
(d) Tea	8 Jam, or cheese, or sardines, or salmon
(e) Supper	9 Beans, or soup, or cheese
(f) Extras	10 Cigarettes, chocolate, boiled sweets, salt and matches

## 2 Nutritive Value - Average for Nine Packs -

Protein	118 gm	Vitamin A	4700 i u
Fat	147 gm	Vitamin B <sub>1</sub>	800 i u
Carbohydrate	426 gm	Riboflavin	2.6 mg
Calories	3600	Ascorbic acid	50 mg
Calcium	610 mg	Nicotinic acid	30 mg

TABLE IV - THE MOUNTAIN (ARCTIC) RATION PACK

<i>Contents -</i>	<i>Item</i>	<i>Amount per man per day</i>		<i>Packing</i>
		<i>g</i>		
1	Peppercorn	6		Paper wrapped.
2	Biscuits, sweetened wholemeal	8		Paper wrapped.
3	Tea, sugar milk powder	2½		In a vacuumized tin.
4	Raisin chocolate	6		Paper wrapped.
5	Oatmeal	2½		In an airtight tin
6	Cheese	4½		In an airtight tin.
7	Margarine	2		In an airtight tin
8	Sugar plaquette	2		Paper wrapped.
9	Bolled sweets	2		Paper wrapped.
10	Bacon	4		In an airtight tin
11	Ascorbic acid	2	25 mg tablets.	
12	Salt	½		Paper wrapped.
13.	A tube of alcohol fuel for starting the primus stove			
14.	An envelope containing six flare matches.			

*Nutrition Value -*

Protein	146 gm.	Vitamin A	3100 I.U.
Fat	292 gm.	Vitamin B <sub>1</sub>	450 I.U.
Carbohydrate	467 gm	Riboflavin	21 mg
Calories	5100	Nicotinic acid	21 mg
Sodium chloride	15 gm.	Ascorbic acid	50 mg
		Vitamin D	110 I.U.

TABLE V - THE TWO-MAN ARMoured FIGHTING VEHICLE  
RATION PACK

<i>Contents -</i>	<i>Item</i>	<i>Quantity and packing</i>	<i>Amount per man per day</i>
1	Biscuit	20 oz	10 oz.
2	Preserved meat	2 tins at 12 oz.	12 oz.
3	Condensed milk	1 tin at 6 oz.	3 oz.
4	Sardines	1 tin at 4 oz.	2 oz.
5	Margarine	1 tin at 2½ oz.	1½ oz.
6	Tea	1 pkt. at 1½ oz.	¾ oz.
7	Sugar	1 pkt at 3 oz.	1½ oz.
8	Canned beans	1 tin at 8 oz.	4 oz.
9	Jam	2 tins at 4 oz.	4 oz.
10	Salt	1 pkt. at ½ oz.	½ oz.

*Nutrition Value -*

Protein	152 gm.	Vitamin A	1200 I.U.
Fat	110 gm.	Vitamin B <sub>1</sub>	530 I.U.
Carbohydrate	560 gm.	Riboflavin	14 mg
Calories	3100	Nicotinic acid	30 mg
Sodium chloride	24 gm.	Ascorbic acid	5 mg



JUNE 1943

## MEDICAL ASPECTS OF AIR/SEA RESCUE

LIEUTENANT-COLONEL JAMES J. SMITH, M.C., U.S. ARMY

I should like to sketch briefly some of the medical aspects of survival in a dinghy and some of the practical problems we have encountered in this connection in the 8th Air Force.

Before I begin, I should like to pay a well-earned tribute to the Air/Sea Rescue Organizations of the Royal Air Force and Royal Navy. They have taken on the responsibility for the actual rescue operations involving all American crewmen forced down on the sea. The universal opinion of U.S. pilots and crewmen is that it is a job that is being well done. We are also particularly appreciative of the special assistance rendered the 8th Air Force by the Air Ministry Directorate of A.S.R.O. in details of ditching drills, training routines, and special equipment. Coming from a country where flying is done between oceans 3,000 miles apart, I must say we knew little about air/sea rescue.

There are several factors that one is concerned with while floating in a little rubber boat on a wide sea.

I. *Cold and exposure.* — This is a factor in the latitudes of the North Sea and English Channel particularly in the winter season. The maximum survival time for a normal individual in the open water around England in winter is about 30 to 60 minutes. In a raft, where there is chance for relative dryness, the chances are considerably better.

Unfortunately, many aircrewmembers, especially fighter pilots, fly in only medium-weight clothing. Still more unfortunately, in the tense moments before and after the ditching — when reaching a raft seems the most important thing in the world — crew members frequently discard outer clothing and heavy boots, so as not to hinder swimming. Some others entertain the fallacy that if they are going to be drowned, wet clothing is of no use to keep warm.

Improving such a situation is largely a matter of discipline and repeated instruction and dinghy drills — emphasizing the points, e.g. that: —

- (a) All boots and heavy clothing should be retained whenever possible.
- (b) Every attempt should be made to recover parachutes and extra clothing for future use in the dinghy.
- (c) Wet clothing offers appreciable protection to exposure and, in any event, the possibility for future drying of the clothing may arise.
- (d) Specifically described exercises should be taken — these should be mild, slow, and periodic, designed to assist the circulation and venous return, but with a minimum effect on the metabolic level. Breathing exercises should be avoided.

II. *Water* - Water is, of course, of crucial importance. It is generally stated that water and flares are the two most important items of dinghy equipment. And it is exactly on such a point as the amount of canned water to be carried in dinghy stowages that there are differences between doctors, engineers, and overall military planners. One is then forcibly reminded that military aircraft were designed to fly fight, and carry bombs and not water. Space and weight allocations are extremely important in aviation. The result has been a compromise - 4 to 6 pints of canned water are carried per man for emergency use in a dinghy. This is of course very little for men who may float ten to thirty days in the open sea.

The available water must be strictly rationed by the dinghy captain. The general procedure used is that no food or water is issued during the first twenty-four hours. On the second and third day, one-quarter of each individual's water supply is given out and the remaining one-half to be apportioned equally to allow for a six to ten day period depending on the captain's estimate of the rescue possibility.

Because of the severe restrictions on weight and space, much effort has been expended to develop chemical conversion processes for making sea water potable. One of the more promising methods is based on a silver protein precipitation and filtration process. This will shortly be in production both in England and the United States. Small sun stills are another possibility - although we are not very hopeful for their use in this theater of war. Rainwater occasionally adds to the available supply.

III. *Food* - At present, we are using the R.A.F. emergency flying ration. It is well designed and is packed in a small waterproof tin box. It contains barley sugar and malted milk, which are high percentage carbohydrate foods. The questioning of ditched crews reveals that barley sugar is almost universally approved because of its flavour and consistency. The malted milk has met with much less favor - mainly because it causes some dryness of the mouth.

Chewing gum is included to help keep the mouth clean and prevent sores of the gums. The last item is 'energy' tablets, consisting of benzedrine, 5 mg. The instructions are that this is a 'last ditch' drug only to be used as a last resort. We have had little success in attempts to determine the practical usefulness of benzedrine for survival in life rafts. In those few instances where we have located survivors who have used it, the answers have indicated that the drug had no effect or maybe helped them a little. For the time being we are planning on continuing its use.

The general instructions for food are that it should be apportioned equally for the entire six to ten days and one-half of the daily ration issued morning and evening. Food should always be taken before water.

The interrogations of ditched crews have shown one very pronounced fact - that palatability of an emergency ration is highly important -

even to a starving man. Many men dislike high carbohydrate foods as a sole constant source of intake. In the past, proteins have generally not been included because of the presumed necessity for additional water to excrete the urea and fats have been omitted because of the difficulty in preservation and also the undesirable taste and consistency of food containing even small amounts of cold fat. I personally believe considerable improvement is possible in dinghy rations, for example along the lines being attempted by Dr. Ancel Keys of the University of Minnesota. He is experimenting with a small volume emergency diet containing protein in amounts of 5 gm. as a daily requirement, fat in amounts up to 20% and small portions of salt. This ration has a high caloric density and appears to have a good consistency and flavor. Recent evidence tends to indicate that protein does not increase water output if it is kept to a low percentage.

The last problem to be mentioned is -

IV *Immersion foot* - A rather common condition if the stay in the raft is longer than a few days.

Although its exact mechanism is unknown, it seems to be produced by a combination of cold (particularly wet cold) and stasis of the lower extremities. In addition to trying to keep the feet and legs as dry as possible, it is believed to be helpful in prevention of this condition to elevate the lower extremities to hip level for 30-minute periods and to use *mild*, centripetally directed massage.

Rescue personnel must be carefully instructed in the care of 'immersion foot', immediate application of heat or strong massage will do considerable harm.

MARCH 1944

## THE TEACHING OF FIRST-AID TO NON-MEDICAL PERSONNEL IN THE BRITISH ARMY

COLONEL D. C. SCOTI, CBE

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With changed conditions of fighting due to mechanization, etc., it is necessary that every man should know something of first-aid. The presence of a badly wounded man in a post or armoured vehicle with no one with sufficient knowledge to help him has inevitably a demoralizing effect on the garrison or crew.

The curriculum of the fighting man is already overburdened. He has a lot to learn and little enough time to learn it in. Therefore we must cut the first-aid teaching to mere essentials and make it as simple and practical as possible.

The medical officer must first enlist the support of the commanding officer and the other officers of the unit. They should realize that it is a duty to alleviate suffering and save men to fight again.

When talking to the men the medical officer must use simple, everyday language. For example, he must talk not of hæmorrhage but of bleeding - a word they know and use - or again, not of fractures but of broken bones. This important point is not often appreciated by the newly qualified medical officer.

Instruction should be given during training hours to small classes not larger than a platoon. It should be dovetailed into whatever training is going on at the time. The instruction should be short, snappy and to the point. They should be told what has happened what is being done and why, as for example, This man has broken his leg any movement of the leg hurts him and may cause him further damage. Therefore we must stop movement and we do this in the following way.

The use of model wounds is of great value as they hold the men's attention, they get used to the sight of wounds and as a result are not so scared when they see the real thing. The model wounds are simple to make out of newspaper paste and a little paint. They are attached to the body by tapes. They are quite realistic and they give the men something to see and work on and something to bandage.

The casualties can be arranged beforehand. The men are then taught to find out what is wrong and to deal with it. With this experience they do not get scared when the real thing comes but deal with it automatically.

The essentials to be taught may be grouped under six headings (1) wounds (2) bleeding (3) broken bones (4) shock (5) burns (6) artificial respiration.

(1) *Wounds* - There is no need for any classification. The men know of bullet, bayonet and shell wounds and are shown examples of each. There is no need to bother them with infection of wounds. All that they require to know is that they must cover the wound, either with their first field dressing or a shell-dressing as soon as possible and fix it firmly.

Wounds of the head, chest and belly require a few words as to the position of the patient, etc.

(2) *Bleeding* - Elaborate descriptions of circulation are not required. The soldier wants to know how he can stop bleeding. Impress on him from the first and repeat it constantly that, in the great majority of wounds, the bleeding can be controlled by a firm bandage over a dressing and that it is only when this fails that a tourniquet is used. Impress on him also that the great majority of wounded do not bleed to death. Finally, show the line of the arteries and how he can, if necessary, control them.

(3) *Broken bones* - Simple and compound fractures and the danger of converting the former into the latter need only be discussed. The

frequency of the association of fractures with wounds should be stressed and the necessity of dealing with the wound first. Splinting must be taught with improvised splints from the men's own equipment as it is all that they will have. The rifle splint should be taught.

(4) *Shock*. - The word is not understood by the average soldier and rather tends to alarm him. It is better to talk of the general condition of the man and how this condition is liable to be lowered after injury or loss of blood and how his general condition can be kept up by warmth, hot drinks and a proper position. They should be taught to anticipate shock and not wait for it to occur. Though blankets will not be available men should be taught that coats are necessary below as well as on top of the patient.

(5) *Burns* are much more frequent because of universal use of petrol, and here again the simplest instruction is necessary. If the first-aid outfit is available, the sulphonamide cream should be used and covered with a dressing. If not, a dressing should be put on or the burn covered with a towel, wrung out in water if possible. *One should be prepared for and treat shock.*

(6) *Artificial respiration*. The necessity for instruction is emphasized by the surprising number of non-swimmers that are encountered, and, with amphibious operations, casualties may occur and lives may be saved. Schafer's method should be taught and its use for poisoning by exhaust gases and charcoal fires should be stressed.

So much for the regimental medical officer. It is the duty of the administrative medical officer, the A.D.M.S., or the D.M.S., to impress on the general staff the necessity for testing out first-aid teaching in all exercises and schemes by arranging for casualties and for their evacuation.

MARCH 1914

## THE TEACHING OF FIRST-AID IN THE AIR TO NON-MEDICAL PERSONNEL IN THE ROYAL AIR FORCE

SQUADRON LEADER D. STAFFORD-CLARK, R.A.F.V.R.

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Lectures to aircrew are one of the most exacting responsibilities of a unit medical officer. He and he alone can ensure that in any medical emergency that may confront his aircrew in the air, or after crashing, ditching, or forced landing, they are equipped with the necessary knowledge and confidence to do what can and often must be done at once to save life or at least improve the chances of ultimate survival.

Aircrew are notoriously resistant to theoretical instruction by the time they arrive at an operational training unit, heavy conversion unit, or squadron they have reached in their own estimation the limit of tolerance to lectures of any kind. A medical officer must therefore summon the full courage of his convictions in the presentation of his material and above all should infuse into his delivery that sense of urgency carefully salted with optimism and good humour that often alone can arrest and hold the interest of his hearers. This is sometimes difficult it may be tiring, discouraging and perhaps on occasions may seem almost thankless. But it is supremely worth doing well. An example of a crew who did not know enough when the crisis came will drive home the moral.

An aircraft landed at an emergency landing ground with severe flak damage and a wounded air-gunner. On examination he was found to be dead. He had bled to death from a comparatively small wound in the popliteal fossa which had involved the popliteal artery, nothing had been done for him although the wound had occurred two hours previously. He was a splendid physical specimen aged 22.

This was a needless tragedy. These young men have so much to contend with and fulfil their duties in combat so bravely that no effort by their medical officers to teach them to help themselves when simple first aid is all that is needed, can be accounted too much trouble. Such efforts at teaching demand the best a doctor can give.

Classes in practical application of dressings and tourniquets, pressure points and the technique of handling tubercle ampoules are invaluable. The technique of first aid in an aircraft flying perhaps three to four miles high above enemy territory at a temperature of  $-40^{\circ}\text{C}$ ., perhaps in the dark, where movement is difficult and oxygen is indispensable, is not easy. It must be simple it must be easy to understand and to remember it must be effective.

Suggested headings for a lecture to aircrew are set out below.

#### SUGGESTED LECTURE HEADINGS

This is not St. John or Red Cross first-aid with detailed instructions for separate anatomical or pathological disasters. It is simply what the aircrew require to know to meet the emergencies that may confront them in the air or after a crash or ditching before professional help is forthcoming. It is applied medical common sense no more and no less. It is all that is necessary.

1. Shock. — What is shock? A state of temporary mental and physical collapse induced by severe mental or physical disaster. Symptoms: man feels ill, is gasping, cold, spent and thirsty. He knows he has been hit somewhere, but feels as if he had been hit all over. Signs: Pale, sweaty, restless with anxious face, fluttering pulse and obviously distressed, for the time being his heart is labouring and his circulation is sluggish.

When does it occur? Practically inseparable from flying casualties.

Why is it important. Stress that it is shock — or haemorrhage — that kills in the first three hours, rather than the particular lesion, no matter where or what that lesion is.

Treat shock first and the patient will be given the best possible chance of being saved later on.

MARCH 1944

## MEDICAL ORGANIZATION FOR AMPHIBIOUS WARFARE, EXPERIENCES OF FOUR LANDINGS IN THE MEDITERRANEAN

MAJOR REX BINNING, R A M C

*Officer i/c No 6 Field Service Unit*

Just before the end of the Tunisian campaign our Brigade was withdrawn and returned to the Delta to prepare for an operation which turned out to be the invasion of Sicily. We arrived at a camp in Genesfa and were confronted with an enormous pile of literature. After working on it for twenty-four hours we obtained the following salient facts

(1) We were to hand in our old and battle-worn medical equipment and draw new

(2) We were to divide our equipment up into three lots. We were to go ashore with our own kit and sufficient medical equipment in packs to last for forty-eight hours. Our 3-tonner would arrive with more on D-plus-1 day and our 15 cwt on D-plus-42.

(3) Meanwhile we were to prepare for the exercise Brightling to be held in the near future.

I will say a word about the exercise Brightling in order to illustrate the care and detail with which the invasion of Sicily was planned. Twenty ships of about 10,000 to 20,000 tons embarked two and a half divisions and a number of corps and Army troops and spent a week in the Red Sea rehearsing getting into assault craft and eventually carried out a landing in the Gulf of Akaba against defences similar to those expected in Sicily. We landed with our kit and our assault packs in a temperature of about 110° in the shade, and this was quite the most strenuous of our four landings. This exercise served to get us acquainted with the ship and those with whom we were going to work.

We then returned to Genesfa and a few days before we re-embarked the brigade commander told those down to the level of company commanders that our destination was Sicily, and explained the Army plan and the brigade plan. We studied scale models of the beaches and many excellent and up-to-date photographs until I knew the place as well as I know my home town. We went aboard again and left for Sicily. During the voyage the models were on view and everyone down to the private had the whole plan explained to him and was made as familiar as possible with the ground.

Our own plan was to go to a certain wine cellar where we would join the light section of a C C S and set up our surgical centre. The

assault troops for the landing went off at 1 a.m. There was not much to see from deck except an air raid on Syracuse, but as soon as it was light we could see the craft ferrying troops ashore and the splashes as shells from the shore batteries sought the range. Then the Navy took a hand and systematically silenced the guns until shelling ceased and the three ships of 10 000 to 25 000 tons in our part of the convoy were able to close in to within half a mile of the shore. This speeded up the disembarkation enormously. Then we were considerably heartened by seeing a L.S.T. creep right into the shore, open its doors, put down the ramp and discharge 16 Sherman tanks. At about 9 a.m. it was our turn to go ashore, which we did without getting our feet wet. We went to the wine cellar which was unfortunately empty except for fleas, and started dealing with some wounded right away. My first job was to give some blood to a U.S. paratrooper who had landed in the wrong place. The quickness with which blood was got ashore is a great tribute to the M.E. Blood Transfusion Service. Valuable as plasma is in many cases there are as many for whom whole blood is much to be preferred.

Our three tonner turned up after forty-eight hours and the 15-cwt about three weeks later. Everything went according to plan.

What lessons can be drawn from that landing? Firstly the Mae West should be blown up before leaving the parent ship. One man in full fighting equipment with grenades and 100 rounds of ammunition fell between the ship and the L.C.I.L. into which he was embarking. He was fished out and was none the worse save for the loss of his rifle. Much to our surprise his Mae West kept him and all his heavy kit afloat.

The next lesson was with regard to the packs. Distances are not great and transport is easily borrowed and we considered that we should have done better to have taken four panniers. These could have been carried at a pinch and would have enabled us to take more bowls and plaster-of-Paris bandages.

There is a tendency to take too many instruments and insufficient plaster-of-Paris bandages. My colleague, Major Jack, has calculated that to do 100 operations requires 500 bandages. One cannot carry that number and one is unlikely to do 100 operations before transport arrives but one must try to get as near that number of bandages as possible.

Vaseline is another material of which it is impossible to take too much, and much the same applies to soap.

Another article which I put on the highest priority is the generator. We carried ashore a Tilley lamp which is all right as a makeshift but the generator must be on the first truck to come ashore. Stories of operating by candle light on the kitchen table read well in the surgeon's biography but are out of place in modern warfare.

These were the lessons of the initial landing in Sicily. It demonstrated



the value of careful planning, attention to detail, and, most important, the use of scale models and aerial photographs. It also showed us that amphibious warfare differs little from warfare in the desert and that the amount of motor transport that goes ashore within a few hours of the assault troops makes too great an insistence on pedestrianism unnecessary.

Towards the end of the Sicilian campaign we had an opportunity of putting these lessons to the test. Beyond Taormina the enemy had succeeded in breaking off our contact with our forward troops by extensive demolitions, and another landing was arranged to take place at Ali Marina some twelve miles from Messina, by commandos supported by tanks of the 4th Armoured Brigade. We were chosen as the surgical team to accompany the party.

This time we carried our equipment in four panniers and took no transport at all. However, we saw the brigadier in charge of the party and he kindly gave us space in his duck for the equipment, and a squadron commander of the tanks let us put ourselves and some extra stretchers on the back of his tanks. We left Catania one night and were landed by the Navy at Acalatta, some four miles nearer Messina than was intended. The commandos held the road for about two miles and we got off the beach with some difficulty. The sappers had to blow down an embankment to get the tanks on to the road. That however was soon done and we occupied the village school and got to work right away. The first patient was the German sapper who had blown the bridge between us and Messina and which held up the tanks for twenty-four hours.

The lesson to be learnt from this landing is, I think, the great co-operation one gets from the combatant side. They understand the value of forward surgery and are always prepared to help in every way. The panniers were much better than packs and enabled us to take far more bowls and other bulky utensils than is possible with packs.

The last landing was made at Salerno.

Having carried out two landings with the assault troops we were rather scornful when we learnt that this time we should not land until D-plus-2 day. However when we landed and found the beach still very much under shell fire we revised our opinion and thought that perhaps we should have left it a little later.

In spite of this the landing at Salerno was the easiest of the three from our point of view. We landed with all our transport from an L.S.T. These seem the big success of amphibious warfare. They carried us and the men in the greatest comfort with hot showers and comfortable bunks together with a large amount of other motor transport as well as our own.

The lessons of Salerno were mainly connected with the transport. L.S.T.s have to be loaded up by reversing the trucks into the hold. Some go on to a lift and are carried up to the upper deck. This is not

an easy operation and our drivers showed up badly compared with some U S Rangers who accompanied us.

Another point is that the LST approaches the beach at about 4 knots and pulls up with quite a jerk on hitting the beach. Naturally the motor transport is inclined to roll when the beach is hit. Some accidents have occurred by over-enthusiastic soldiers taking off the securing chains too soon and getting crushed between two trucks. The other lesson is that the de waterproofing area is an unhealthy place at the best of times.

APRIL 1944

## MAN POWER CONSERVATION REHABILITATION AND RE-CLASSIFICATION IN THE R.A.F

GROUP CAPTAIN C. J. S. O'MALLEY O.B.E., R.A.F

*Officer responsible for co-ordination of rehabilitation in the R.A.F*

Medical rehabilitation is the process whereby a man is made mentally, physically, socially and technically the equivalent of what he was before he became sick or injured, and in that order. If we fail to make him equivalent then we have to resettle him.

Rehabilitation starts the moment the patient goes into hospital and does not finish until he is back on his job.

But a rehabilitation centre should be geographically separate from the hospitals although allied to them. The cult of self-endeavour is not easily implemented in a hospital where there is an atmosphere of morbidity. The rehabilitation unit should be as separate from the ordinary hospital in thought as it is in space.

The production of a feeling of well-being - a very important part of rehabilitation. How do we produce this feeling? How do we overcome the apathy, ennui and inertia of the sick or injured man? First, we divorce him entirely from the hospital atmosphere and put him in a good environment.

The programme and organization should run smoothly and the staff should be extremely carefully selected. It is organized on the lines of a club and not on the rather restricted regimentation of a hospital.

The main problem in the early stages is to try and get the injured man into the right frame of mind. First, we do it by good reception - not the usual R.A.F. type of reception. The patients come from hospital as soon as they are fit to be moved either in an unpadded plaster or as soon as their stitches are out. They are received in the library which is pleasantly furnished and has a very wide range of books of every type, from some of the rather bizarre Wild Westerns to those on sociological problems catering for every taste. The

receptionist is a W.A.A F. N.C O. with a pleasing and urbane personality. Some patients arrive in a very disgruntled frame of mind and are inclined to project their feelings on the institute or its inhabitants.

Orders, which are unfortunately necessary, even in a rehabilitation centre, are compiled in a very light-hearted manner, and there is a foreword explaining what we are trying to do. Here in the library appointments are made to see the medical officer, dental officer, commanding officer and accountant officer – the latter has been shown to be necessary to clarify financial problems. Even regarding serious subjects we try to have a very light-hearted approach both by word of mouth and by poster.

Rehabilitation in the R A F was first organized in 1939 at the Palace Hotel, Torquay, which was the Officers' Hospital. This hospital was bombed in 1942. The hospital and the rehabilitation organization were then separated, the former going to Cleveleys Hotel, Blackpool, and the latter to Loughborough College.

The Loughborough College has accommodation for 250 officers and 250 airmen, complete with playing fields, gymnasium and swimming bath. It also has a slightly academic atmosphere, which we have found to be an improvement on the rather too restful atmosphere of the luxury hotel or spacious country house.

The programme in the large gymnasium is that patients work in injury groups. These groups are graded into early cases taken by physiotherapists and intermediate and late cases taken by physical training instructors who have been specially selected, for their personality and who have been working for some time in the organization. We have found that we cannot take physical training instructors in permanently until we have had them for at least a month, to see if they are the right type of men.

There must be a good relationship between all the people concerned; the medical officer, the physical fitness officer, the physiotherapists and the physical training instructors who comprise the rehabilitation team. The medical officer sees the patient and makes out the programme. He briefs the physical fitness officer, who is responsible for the P.T. instructors carrying out the programme. The patient is then introduced to his instructor in the gymnasium and afterwards briefed on what he is going to do in front of the P.T. instructor, and the instructor is briefed in front of the patient. Then there is no conflict; no misunderstanding.

Airmen patients are dressed uniformly in sports kit, and officers are allowed to wear any clothes suitable for taking exercise, and only dress in uniform for dinner. The R A F. pilot is an individual, and likes to wear his own choice of clothes which emphasize his individuality.

We find that swimming is the best non-weight-bearing exercise. A man may not be able to move a limb more than to a certain degree –

simply because he is afraid to do so. If this man is put in the water where he either has to sink or swim - all in a light hearted atmosphere - he moves his limb to the required degree unconsciously. A patient can be exercised in a swimming bath before he is allowed to walk.

There are small wards for officers and airmen where the patient stays for 48 hours after his plaster has been removed or while his new plaster is drying. It has been proved that if exercise is done regularly in bed for two or three days after the removal of plaster, very little or no swelling appears at all. Post plaster oedema is a thing of the past.

Adjoining the large gymnasium are two spacious physiotherapy rooms where treatment is given to early cases to stimulate the circulation and muscles, and to enable the man to perform his exercises. The day has gone when a patient lies back and is massaged by a physiotherapist without making any effort himself. Massage and heat are given as ancillary aids to exercises.

The next stage to help a man to take more exercise is an early walking class for patients who have had plasters off for two or three days and are having the first instruction in learning to walk again. At first a man is afraid to walk and the primary thing which must be done is to get rid of self-consciousness. Mass-suggestion here comes into play. If 100 people are doing the same thing the injured man is encouraged to do something which otherwise he thought he could not do.

We use the method of the indirect approach in our application of pastimes such as badminton, clay pigeon shooting, lumbering and boating. Squadron Leader Dan Maskell (Davis Cup tennis coach) with his understanding of teaching, his industry and sympathy has been magnificent in this work, and it is interesting to watch him with a patient with an injured shoulder playing badminton placing the shuttlecock further and further back so that in the man's endeavour to play the game he is unconsciously increasing his range of movement. It has been proved that the more intelligent a man is the less apparatus work he needs. While a man will row on a river for a whole afternoon, he would not work on arm-pulleys all the afternoon. A man will chop down trees for hours, but he will not work on apparatus with the same spirit.

While swimming is the best non weight bearing exercise, cycling is the best mild-weight bearing exercise. Organized cycle rides are part of the routine and provided that the ride is purposive, e.g. to take a glass of milk or a cup of tea in a pleasant environment, then they are very popular.

Volley ball is considered the best rehabilitation game. In this game there is a competition every week between the classes, and the winning class plays the instructors, who are heavily handicapped.

I will say a word about occupational therapy which is nearly always a diversion. Injuries to hands and forearms profit mainly by this form of therapy. Pottery work is good for burnt hands as the clay

has a healing effect on burnt skin, and the exercise is beneficial. Carpentering is good. We have a vocational re-training organization, a rehabilitation workshop. Occupational therapy is realistic here. I do not feel that 'tattooing' and weaving has any place in an airman's life, but he will appreciate the mental stimulus given by learning navigation again, or working on engines which he will go back to when he is fit, or working on airframes. There is no yardstick whereby a man's ability and willingness to work can be measured, except by giving him work. Hospitals now send patients with the following note: 'To work in the rehabilitation workshops at Loughborough in order to assess his ability and willingness to go back to his trade.' In this section we have taken crashed wireless sets from tanks and aircraft and rebuilt them to make wireless sets for the troops. All this is real and provides interest, and gives the man a feeling of achievement.

By these methods we may make a man physically, mentally and technically the equivalent of what he was before he was injured. It may also be necessary to rehabilitate him socially. He may have been a prisoner or in hospital for a long time. We arrange lectures by prominent people, "brains trusts," etc. This stimulation of thought is most important. Dances are arranged, and help both in the physical and mental aspects of this work.

We try to get patients to talk, by arranging one evening a week for a series of short talks, of 20 minutes' duration, by any patient on any subject he likes.

It is only by an accurate survey of results and of lengths of stay for various disabilities that a review can be made of the progress of the unit. In order that an accurate record be made of the work done, a statistical clerk must be available. A unit such as this can easily deteriorate into a pleasant country club and in time of war when escapism is a most infectious disease, a continued review of the results is of great importance. Patients are reviewed by the medical officer, with the instructor present, at least once a week. The art of rehabilitation is good timing, grading into the right class at the right time.

Rehabilitation depends a great deal on indirect approach. It is not difficult to make a patient put his injured joint through its range of movement. The art of rehabilitation is to make the man do it willingly and regularly throughout the day's programme. In the early stages he does not want to do anything. Take him away from a hospital atmosphere, put him in an atmosphere of endeavour and by that mass-suggestion we have furthered our programme. Last year, 3,500 patients - officers, airmen, tradesmen and pilots - passed through the establishment. Of the pilots, 92% went back to flying, 64% to operational flying. We have had some cases of pilots coming two and three times, each for a different injury. 84% of tradesmen went back to their trades. 8% of pilots and 16% of tradesmen were invalided. This work

has been proved. In the last analysis it is a repair and salvage depot of human beings.

We think we have proved the efficiency of rehabilitation by our results. We have not yet produced the ideal organization, but it has progressed as a result of the experiences of the last four years.

We think the rehabilitation workshop has come to stay but care must be taken that it does not become the refuge of escapists. The periods spent in this workshop should be the shortest period to enable a patient to fulfil his destiny in the R.A.F. Occupational therapy should be made realistic, and tatting, loomwork, etc. have little place in a Service establishment.

Our prime aim in the early stages as well as the late ones should be to stimulate the mental endeavour of each and every patient. Now that the trained physiotherapist has absorbed the doctrine of activity, this form of therapeutics can be extremely useful.

Is there a place for a neuropsychiatrist in a unit such as this? We feel very strongly that there is not. He should visit the organization often and observe, advise and record but he should not see individual patients at the unit. Patients should be sent to him and where that patient has gone should not be known by his fellows. A man's mental and emotional life is something that is very precious to him. The fact that he is in difficulties should not be known by his fellows and there is no surer way of ridiculing a human being than for his comrades to say "I see you went to see the 'looney' doctor to-day".

Is there a place here for a patient suffering from nervous exhaustion and fatigue? Yes, provided that he has a normal nervous constitution. It should be our aim to take patients who are of normal constitution subjected to abnormal strain, but we have no place for the basically abnormal personality.

We have already formulated our ideas of an ideal rehabilitation centre: a good environment with good climate near the sea and near a town where social and cultural amenities can be obtained; a large amount of covered floor space for exercising, with a heated swimming bath which can be converted to an open air one in summer; good varied food; comfortable beds and recreation rooms; a library embracing every type of reference, scientific and fictional book; wide playing fields with a good sub-soil drainage; workshops where occupational therapy can be realistic. These are all important, but a centre might have all these and fail if it is not staffed by personalities from the lowest to the highest, who have enthusiasm, understanding, sympathy and endeavour in their souls.

## MAN-POWER CONSERVATION REHABILITATION AND RE-CLASSIFICATION IN THE ROYAL NAVY

SURGEON LIEUTENANT-COMMANDER F G WARD, R.N.V.R.

*Senior Medical Officer, R.N. Orthopaedic Rehabilitation Centre*

The two problems of rehabilitation and reclassification of Service personnel in the Royal Navy are interconnected but I shall consider them separately

Rehabilitation after injury includes the restoration of the injured part to full function, the redevelopment and maintenance of the rest of the body and the profitable occupation of the mind. The word *maintenance* is important. These principles have been applied in the hospital in which I am serving, with good results. As an example, 93% of the meniscectomy cases have been returned to duty within eight weeks of operation, including two weeks' sick leave. This has been achieved by very early and persistent *supervised* exercises in the wards, with the result that by the time the patient reaches the early ambulant stage he is thoroughly 'active movement minded'.

Physiotherapy is needed for the fracture and other traumatic cases rather than after meniscectomy but in this again the prevailing principle is active movement, to the attainment of which massage and electricity are only ancillary. Treatment is continued and concluded in the gymnasium under the rehabilitation medical officer and physical and rehabilitation training instructor, and by individual and group exercises and suitably graded and adapted general P.T. each man is made not only fit but confident in his fitness.

The two orthopaedic rehabilitation centres are working in conjunction with naval hospitals. The advantages of the centres are that, free from the hospital routine, a more intensive course of treatment is possible and that their environment exercises a good and often dramatic influence on the patients' mental attitude. The methods employed at both centres are basically the same: the restoration of function by active movements, combined with the maximum of general activity. These are secured by individual and group exercises, remedial games, cycling, country rambles and 'occupational therapy'. Whether he is in a rehabilitation centre or not there is scope for the treatment of a man by occupation at a man's job in the stage between discharge from hospital and the ability to undertake full duty. In the depots such a scheme of employment depends for its success on the liaison between the medical and executive branches, and to succeed, this liaison must be by personal and not by mere paper contact. The moral rehabilitation of being once more a useful member of the Service is incalculable.

The two neuropsychiatric centres differ widely in type one is a large camp under executive control in which ratings with some constitutional inferiority' are retained for three months or more to adapt them to shore or harbour service they tend to relapse if sent to sea. The other is under medical control and constitutes a hardening centre for men of a better type who have broken down temporarily under the stress of active service. The duration of treatment rarely exceeds eight weeks and the majority return to service afloat. The importance of the personal touch is keenly appreciated in this very successful centre.

I have myself been concerned only with rehabilitation after injuries or orthopaedic operations and I only speak as an observer of the treatment of other types of case but I am convinced that what is referred to as orthopaedic rehabilitation must be tackled in special centres apart from medical and general surgical cases, both on account of the longer time needed to get injured men fit and of their need for individual and personal interest and attention.

*Reclassification* - The aim of all treatment is to get the patient back to full duty in the Service but there is room in any service for a number of men with limited disability who can release fit men from light jobs. For these there are the alternatives of a preliminary period of light duty on shore or harbour service at home or overseas for stated periods, varying from a few months to permanently. For men with an established disability the choice between permanent home shore service and invaliding depends to a great extent upon their value to the Service as trained and skilled personnel. Every effort is made to retain the services of skilled men if only in a limited capacity but even the untrained are seen well on the way to their maximum recovery before they are put on the beach.

As junior officers we are impressed with the importance of discharging patients to duty with an adequate covering letter but even so it is not easy for a drafting commander with numbers up to four figures awaiting draft to dispose of all the men returned from hospital satisfactorily. At one depot this difficulty is tackled particularly well by a close personal liaison between the senior medical officer and the drafting officer.

The upgrading of cases after entry is another method of making the best use of available manpower. A special establishment was set up for this purpose largely staffed by P & R.T personnel, for men downgraded on entry by civilian medical boards. Some were found to be erroneously downgraded and others quite unsuitable, but of the rest 2 500 in number 93% were trained up to Grade I by an intensive eight weeks course, and of these 75% were followed up through their next period of naval training and none had broken down during this very strenuous time. The secret of the success of this establishment was the spirit engendered by the enthusiasm of the staff and the challenge to the



pride and the good response of the downgraded men themselves. This establishment closed down just in time to furnish trained instructors for both orthopædic rehabilitation centres.

APRIL 1944

## THE REPLACEMENT SYSTEM OF THE UNITED STATES ARMY

(PART I)

COLONEL GEORGE G. DURST, M.C., U.S. ARMY

*Chief Surgeon of the Field Force Replacement System, European Theater of Operations*

The replacement system in the U.S. Army constitutes one of the links in the manpower conservation chain (Chart 1). Hospitals and convalescent centers send men, when recovered, into the replacement system for reassignment. They are reassigned to their former units if physically qualified. If no longer qualified to return to their former units, suitable assignments are made.

The replacement system is that agency which maintains Army units at their authorized manpower strength. Men to replace battle and attrition losses are furnished to units in specified categories in response to requisitions. The operational units of the field force replacement system are the individual replacement depots with their attached replacement battalions. Replacements are supplied by the field force replacement system to all units of the theater except those of the Air Corps, which has its own replacement organization.

The replacement system acts as a receiving, holding, and assigning agency (Chart 2). Replacements are received from several sources, replacement centers in the zone of interior, from hospitals and convalescent centers and other miscellaneous sources in this theater, such as the disciplinary training camp. The flow of replacements in response to requisitions must be orderly, and in order to make it so, a reservoir is maintained at approximately their anticipated requirement ratio. Appropriate training programs are conducted for these men awaiting assignment. Men are assigned from the depots and shipped to units in response to requisitions. The requisitions are made in terms of specific vacancies for which men with specific qualifications are required. In the U.S. Army, every soldier has a qualification card, on which is recorded information as to his civilian and military qualifications. Based on these qualifications, each is assigned a military occupational specialty, which has a code number and this is recorded on his qualification card. As additional training and experience is gained, additional specialties in which the man is qualified are

recorded. Requisitions are filled in terms of specific qualifications for specific vacancies by consulting the requisitions and the individual qualification cards.

The physical capacity of the individual must, however, be considered before a man is assigned as a replacement, for he must not only be trained for the job he must be physically capable of performing it under the conditions he will be expected to encounter.

The hospitals are the largest, but not the only, agency from which are received men who may have a physical or mental limitation that must be considered before the replacement system assigns them. All men coming into the replacement system are given a medical screening examination (Chart 3). This is given as an interview and brief examination usually combined with the communicable disease examination given on arrival. At this time each man is given an

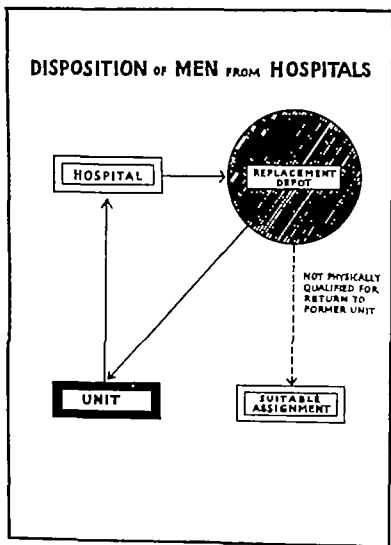


CHART 1

opportunity to call attention to any defect or disability he has and to have the examiner note it. Those men who come from hospitals bring a hospital report and recommendation as to type of assignment for which qualified. This is noted by the depot medical officer. Based on the screening examination and (on those who come from hospitals) the hospital recommendations, all men received are divided into two broad groups according to their physical qualifications: -

1 Those who are physically qualified for general military service

2 Those who require special assignment consideration because of some mental or physical handicap

Those men who are qualified for general military service are reported to the depot assignment section as available, and will be assigned with no further medical considerations

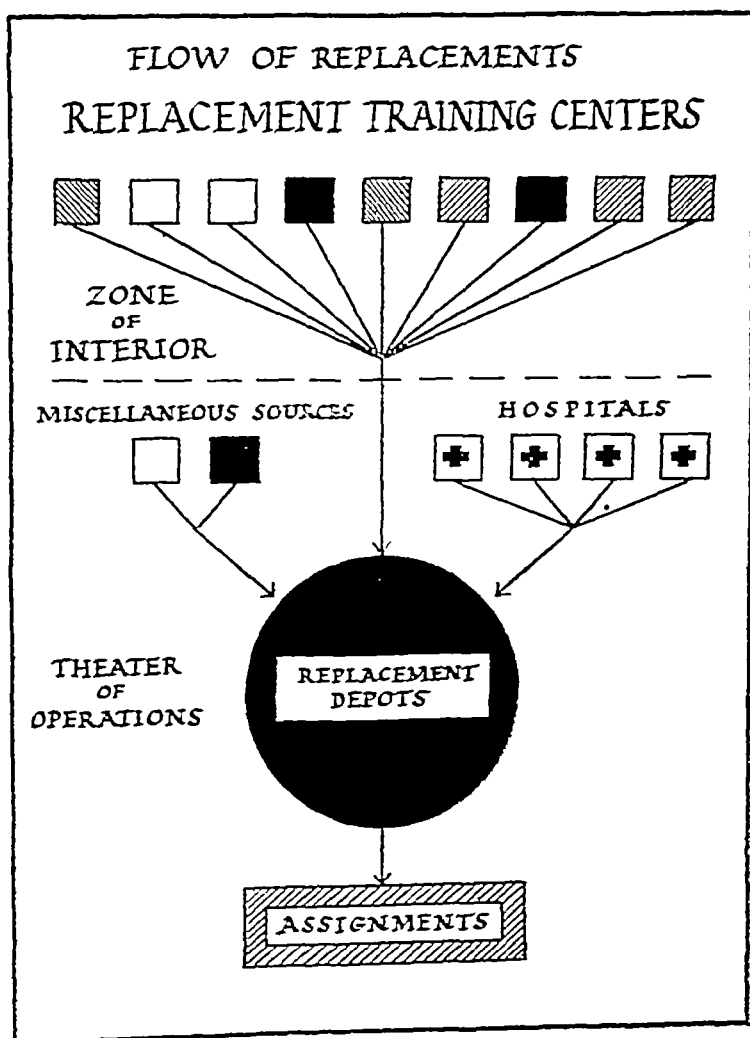


CHART 2

Those who have some physical or emotional limitation that must be considered before they are assigned are referred to a Classification and Assignment Board, composed of a medical officer a classification officer and a line officer (Chart 4) Each man appears in person before this board, where he is interviewed and an evaluation is made of his qualifications and limitations in terms of current and anticipated personnel requirements. Based on a consideration of all the factors involved the Board makes a recommendation as to the type of unit and military occupational specialty to which he is qualified for assignment. An appropriate notation of this recommendation is made on the man's service record and qualification card Assignment from the depot is then made by the depot assignment section in accordance with this recommendation.

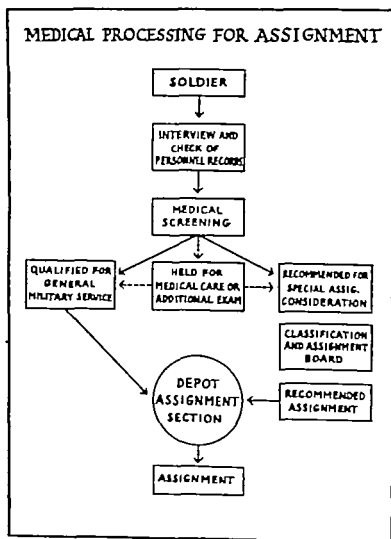


CHART 3

## SUMMARY

Many of the men coming from hospitals can be returned to their former units either in their previous or in a new military occupational specialty. Men are returned to their former unit in all cases where this is consistent with their qualifications. Morale is important, the depot Classification and Assignment Board explains to each man what their purpose is and endeavors to instil an enthusiasm and interest in him for his new assignment. Each man is made to feel the importance of

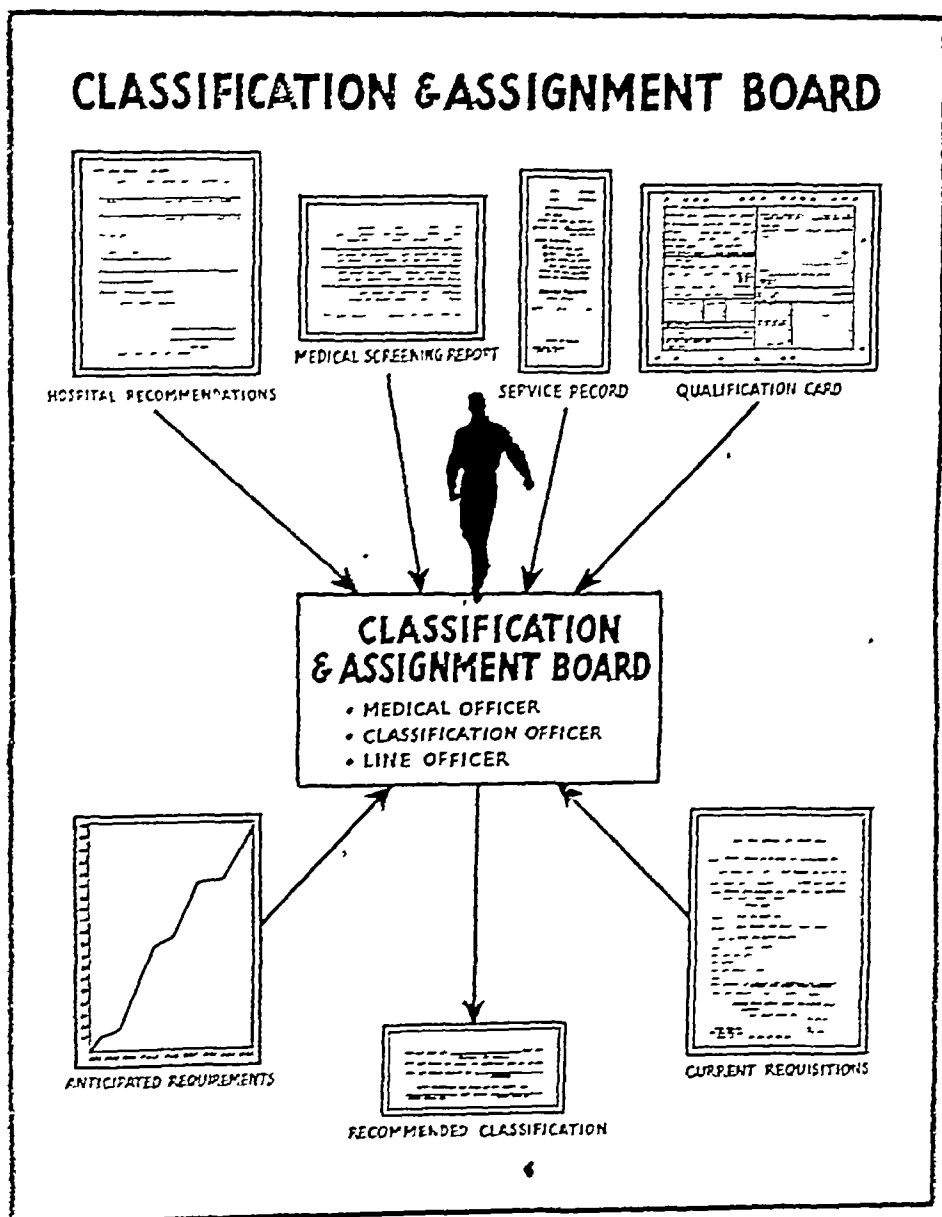


CHART 4

his individual contribution. The effect of this on the man's morale and future performance of duties cannot be overemphasized.

(Note - Subsequent to the delivery of this paper the U.S. Army adopted 'The Profile System of Physical Classification. This classifies each of the major body functions according to four grades of proficiency. Job assignments are based on this classification. Changes in an individual's classification are made by reference to a board of officers similar to that described above. I believe this system is a distinct advancement in our efforts to obtain the maximum efficient utilization of available manpower - G G D)

APRIL 1944

## THE REPLACEMENT SYSTEM OF THE UNITED STATES ARMY

### (PART II)

MAJOR MILTON FEINBERG M.C., U.S. ARMY

*Chief of the Medical Processing Section, 10th Replacement Depot*

The procedure by which assignment at a replacement depot is made is known as processing and consists of two inter related functions, namely (1) medical evaluation and (2) classification. The objectives and methods of conducting this processing were outlined in the preceding presentation by Colonel Durst.

During a 9-month period at the 10th Replacement Depot, 56,352 troops were processed. At that time this was the only functioning replacement depot in the United Kingdom and all replacements passed through this depot. From this group 1,457 or 2.58% were recommended for limited assignment.

The sources of the soldiers processed are shown by Chart 5. 46,799 were incoming replacements from outside the United Kingdom, 5,379 were from hospitals, 2,615 were transferred directly from their previous unit for reassignment, 1,559 were soldiers released from detention.

Chart 6 shows the percentage of men from each source who were given special assignment consideration. 0.49% of those coming from outside the United Kingdom, 4.4% of those released from detention, 15.5% of the soldiers transferred from hospitals, and 12.3% of the soldiers transferred directly from their parent unit were placed in this classification. This latter group of soldiers was transferred from their unit because they were either physically or mentally unable to perform their duties, or they did not possess the military qualifications necessary in that unit. In some cases they were transferred to the replacement

depot due to reorganization of their former unit. In accordance with present directives, soldiers unable to perform duties in a unit because of physical or mental conditions would now be hospitalized for physical examination and therapy, and then discharged to a replacement depot.

Chart 6 also shows the sources of the men recommended for limited assignment. 25.24% came from hospitals, 22.1% directly from their unit, 15.86% from Zone of Interior, and 4.8% were released from detention. From this it can be seen that the largest group of men requiring special assignment consideration were soldiers who had been hospitalized, even though the number of men coming from hospitals was only a small percentage of the total number of incoming replacements.

Of the conditions which prevented the performance of full duty,

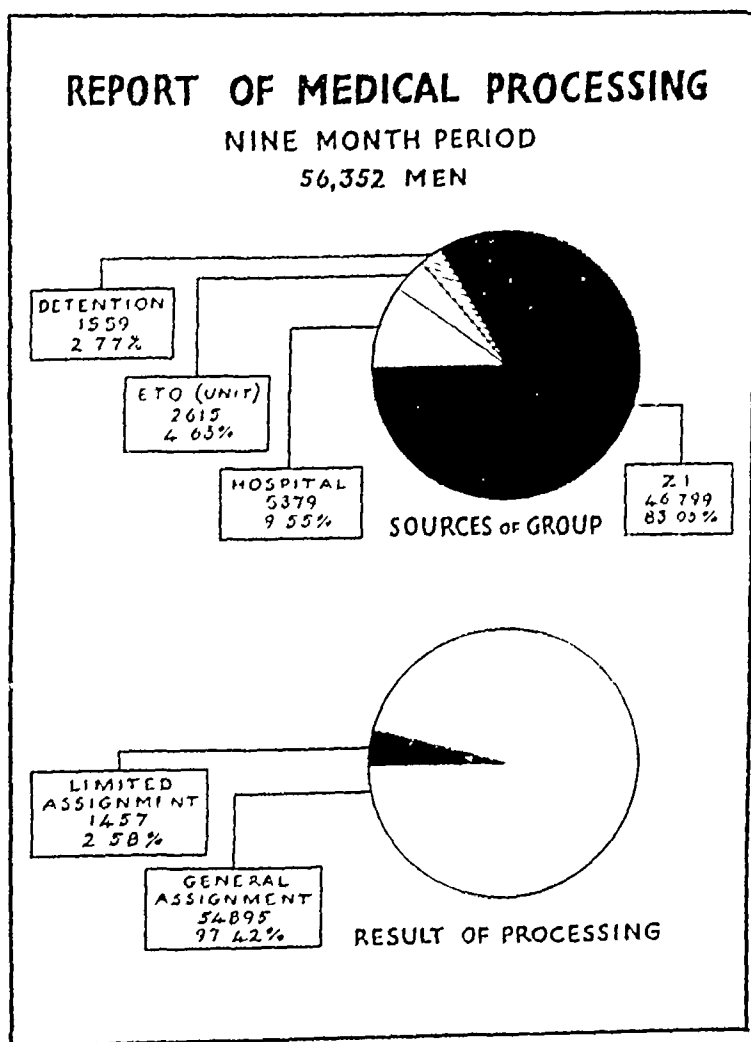


CHART 5

orthopedic disabilities were the commonest. Chart 7 shows the various groups of disabilities encountered by systems. Symptomatic pes planus was found to be the most frequent single cause of limitation, accounting for 32% of all cases. Psychoneurosis was the second commonest cause accounting for 7% of the cases.

These figures are an indication of the type of problem which the Classification and Assignment Board most frequently encounters. Men who cannot march long distances or stand for long periods can still provide useful service to the Army if consideration is given to their proper placement. Psychoneurotics, except for a few very mild cases, are placed in Service units where they will not have too much emotional stress. The hospital recommendation or report of consulting psychiatrist is of great value in assigning this type of soldier.

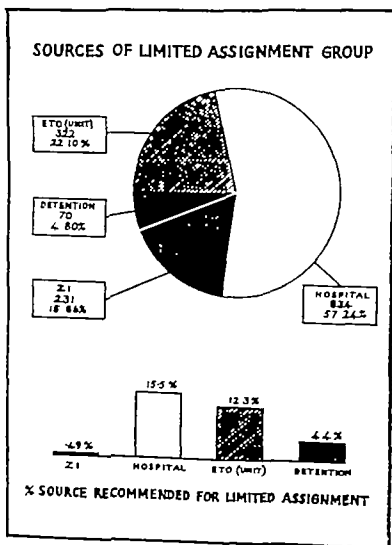


CHART 6



## SUMMARY

In the classification procedure each case must be considered as an individual one. The assignment of a soldier is based upon physical and mental capabilities, past and present training, special skills and aptitudes, available assignments and estimates of future assignment requirements. Finally, the classification and reassignment of soldiers unable to perform general military service is a joint responsibility of medical officer, classification officer, and line officer.

(Note - These data were collected in the United Kingdom prior to the invasion of the Continent by ground force troops and therefore do not reflect the effects of combat on the number of troops that require special assignment consideration nor the types of disabilities associated with combat. Such data have now been collected and are to be presented for publication at a later date - G G D)

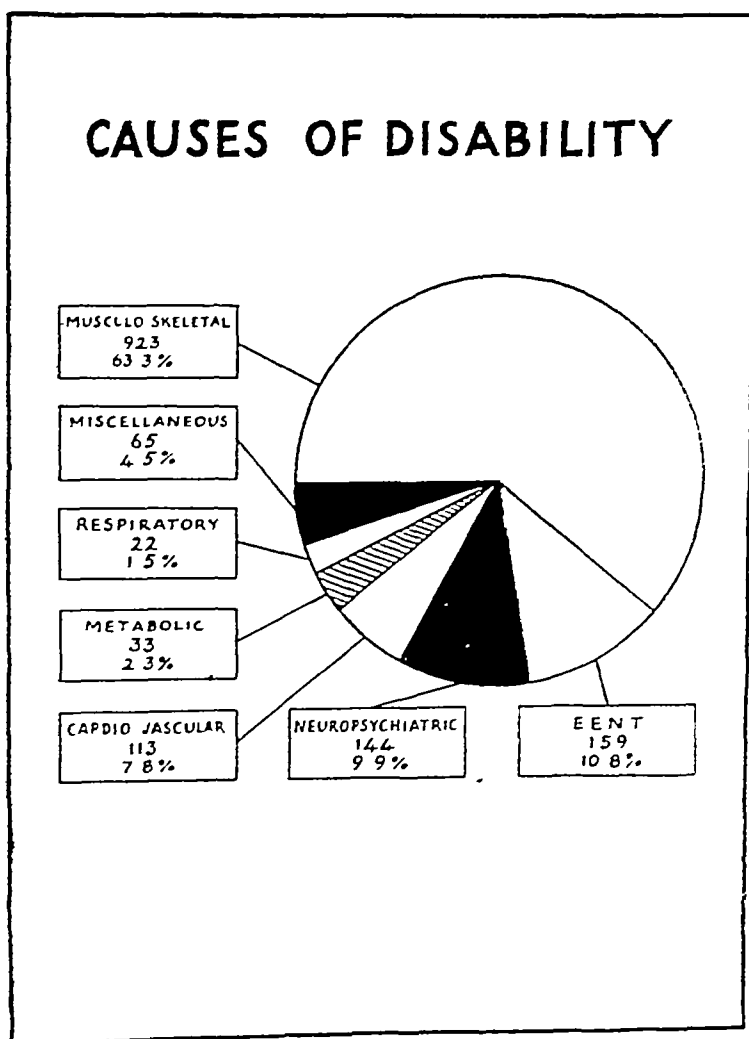


CHART 7

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### General Medicine and Tropical Diseases

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## THE WORK OF THE R A F NUTRITION TEAM

### SQUADRON LEADER SIMON YUDKIN R.A.F

The functions of the R.A.F. nutrition team are to assist in maintaining an adequate and nutritious diet for all W.A.A.F. and R.A.F. personnel and to investigate specific nutritional problems as they arise.

In the maintenance of a good diet, great importance is attached to teaching and training catering officers and cooks in the general principles of nutrition. Medical officers, too, are taught something of scientific methods of cooking and catering and are reminded of their duties concerning the diet of the men and women in the Services. Visits to numerous R.A.F. stations in this country and overseas have helped us to appreciate some of the many problems that arise.

Many investigations have been carried out to determine how best to preserve nutrients in food cooked on a large scale. Methods of cooking vegetables have been devised which retain much of the vitamins contained in the fresh product, and these methods are now taught and practised. Other investigations have confirmed the value of sprouting dried peas and beans before cooking when fresh vegetables are in short supply. We have devoted a good deal of attention to the question of palatability and have tested the palatability of many kinds of foods including a variety of special rations and of several dehydrated food stuffs.

Although methods such as these may help to maintain a good diet, frequent checks must be made of the actual intake of nutrients. This is usually done by estimation from food tables of the nutrient value of foods coming into kitchens: catering officers are required to check the calorific value of the diet in this way. Direct analyses have also been made of the food as served to the men and the actual intake of a large number of nutrients has thus been determined. It has been found, for example, that the calorific value as estimated from the food tables is usually too high by about 15% and the ascorbic acid intake also is much less than would be expected from the tables. The iron and calcium intakes on the other hand are higher: the extra iron coming from iron cooking vessels and the extra calcium being deposited from hard waters used in cooking. The biological value of the mixed proteins of the diet has been determined and has been found to be equal to that of the mixed proteins of milk, although only about 40% of the total protein is of animal origin. The amino-acids of different foodstuffs evidently supplement each other to a hitherto unrecognized degree. About 1,200 ml. of water is consumed in the food apart from beverages, this amount being almost sufficient in itself to maintain men in water equilibrium in temperate climates.

Besides this method of checking the adequacy of the diet, we have also been constantly searching for signs of deficiency amongst the men themselves. If the nutritional status of personnel just posted to a particular area is compared with that of personnel stationed in the area for some time it is possible to decide whether the diet in the area is adequate and also to distinguish the effects of the diet from those due to climatic conditions. By combining the results of such surveys with the results of direct analyses of the diet, information concerning the requirements of certain nutrients may be obtained.

When signs of deficiency are found, the opportunity is usually taken to obtain evidence on the value of these signs. We have been able to show, for example, that riboflavin is not the only nutrient required to maintain the normal avascularity of the cornea, but that other vitamins associated with fresh fruit and vegetables are required. Similarly we have found that when fresh fruit and vegetables are in short supply, poor dark adaptation may develop even if the vitamin A intake is apparently adequate. It has been found also that the incidence of bleeding gums in the R.A.F. is not related to the intake of ascorbic acid and that this vitamin has no specific value in preventing or stopping the hæmorrhage.

We have constantly observed that signs of nutritional inadequacy occur in regions where pure vitamins have been issued to prevent deficiency caused by the lack of fresh products in the dietary. Indeed, we have now come to expect to find signs of deficiency where vitamin pills are issued. This is scarcely surprising, for there are probably a score or more essential nutrients in, for example, fresh fruits and vegetables, whereas only about six nutrients can reasonably be supplied in the form of pills.

APRIL 1943

## MALARIA AND DYSENTERY ON ACTIVE SERVICE

MAJOR-GENERAL R. PRIEST, CB, MD, FRCP, DTM AND II

*Acting Consulting Physician to the Army War Office*

*Malaria*—The latter end of the eighteenth century saw the earliest attempts at preventive or what is now spoken of as suppressive medication and it was administered in the form of Peruvian bark. Later, this became replaced by cinchona and later still by one of its alkaloids. For many years past it has been the custom for every European living in hyperendemic malarious regions like West Africa to take 5 grains of quinine a day.

Since its inception this form of treatment has been strongly advocated

by some and forcibly condemned as valueless by others. Those who have held the latter view have been responsible for at least two expeditions to West Africa proving disastrous to our troops on account of malaria.

In this war too a few medical officers, possessing no experience of malaria under natural conditions, have declared suppressive treatment to be useless, only to learn by bitter experience the wastage by sickness and death that can be caused by malaria, an enemy more dangerous than the German. These officers have done incalculable harm by expressing such ill-advised opinions to troops and their commanders.

Should there remain anyone who doubts the efficacy of this form of treatment, let me quote an episode of this war. A certain force was due to arrive in a hyperendemic area, we will say on the 5th of a certain month. Suppressive quinine in 5 grain daily doses was given to the troops from the 1st day of the month i.e. five days before arrival, and was continued until the 9th, i.e. four days after arrival, on which date the supply of quinine unfortunately ran out. The troops were withdrawn from the area on the 18th and 19th days and up till then all appeared to be well except for a few febrile cases which were thought to be sand fly fever chills, etc.

In one group of the force on the 20th the first case of malignant tertian malaria was diagnosed, there arose 25 cases on the 22nd, 40 on the 24th, 59 on the 26th thereafter the cases gradually diminished but by the 7th or 8th of the next month no less than 401 cases had occurred, with 15 deaths. This episode shows that the small dose of 5 grains a day did help to some extent in keeping the greater portion of the troops sufficiently fit to carry out the operation required of them.

How essential it is to have some personal protective medication until full anti malarial measures can be put into force is further shown when it is learnt that in one year nearly 24,000 cases were admitted to hospital, varying from 900 per month to nearly 4,000 a month while in another area admissions for malaria formed 60 % of the total in one month.

I think the dispute as to whether suppressive medication is or is not of value is because the dosage has been either inadequate or irregular, thereby resulting in partial or incomplete suppression. I consider it is our duty as medical officers to try to keep the greatest number of troops fit to carry out an operation required by the army commander. We must therefore be prepared to advise the safest maximal dose of a given suppressive drug to the majority and we must not reduce this dose just because a small minority of men may show some idiosyncrasy to the drug. In other words, it is far better to have to treat only 20 susceptible men in a force than to have to treat 4,000 men in hospital suffering from malaria.

Hitherto as I have said, it has been customary to use quinine, but nowadays, owing to the loss of Java, one of the main sources of supply we have had to look for some other substance. Fortunately atebrin or

its British equivalent, mepacrine, was already at hand, unfortunately, however, we had had very little opportunity of trying out the drug on active service for suppressive medication, on a large scale. We knew that 0.1 gm. twice weekly was a safe dose for Indian coolies. In West Africa it has been shown that 0.2 gm mepacrine per week has less suppressive value than 5 grains of quinine a day, also that 0.4 gm. a week has a greater value than 5 grains of quinine, and we had the work of Field in Malaya with 0.2 gm twice weekly. We learnt later that the Germans were giving 0.06 gm a day of atabrin and this dosage made many of them yellow. The combination of post-mortem lividity together with atabrin coloration made the dead bodies of Germans appear green and our troops thought that the faces of the dead had been deliberately camouflaged.

Medical officers returning from West Africa reported that no ill-effects were produced in men who had received 0.1 gm daily over a period of many weeks.

\*In October (1942) our Director-General called a meeting of consultants in tropical medicine, civilian and Army, together with specialists who had recently returned from overseas theatres of war. It was unanimously decided to give our troops 0.1 gm mepacrine on every day of the week, except Sunday. This will be commenced seven days before reaching a hyperendemic area and will be continued throughout the term of residence therein and for one month after leaving it. I have heard privately that 0.1 gm a day can be taken without toxic effects, also that some prefer it to quinine. The reports show that effects such as nausea, vomiting and colic disappear as tolerance to the drug becomes established. The skin will become yellow in many instances and this will create a prejudice against mepacrine and I feel sure our nursing officers will regard this additional pigment to their morning freshness with dismay.

If rumour be true, we have good reason to believe that we are on the threshold of an important discovery that either mepacrine itself or one of the other substances now under trial will prove to be the long-looked-for *therapna magna sterilans*.

It has yet to be established whether mepacrine kills the sporozoites or whether it has a lethal action on the very early ring forms (or early schizonts).

Sir John Pringle, physician general to the Army about 200 years ago, who may be regarded as the father of Military Hygiene, wrote 'Not on medicine does the health of the Army depend, but on those who have command.'

The suppressive drug, when advised, must come to the unit as part of the daily ration and the officers of the unit must be held responsible that the drug is given and that it is given *regularly*, whether the troops are operating in companies, platoons or as scattered individuals. The

medical officer is available for advice and helpful criticism and it is he who will carry out any of the known tests to see if men are receiving their daily dosage.

Just as troops are taught weapon-training street fighting gas and tank tactics I consider they should have training in malaria tactics when a film with commentary could be shown embracing all aspects of anti malarial measures, together with actual practice with veils, nets, creams, clothing etc.

It will be remembered that in the Army we have what is known as the Army standard treatment of malaria, which originally consisted of quinine, 10 grains, thrice daily for two days, mepacrine 0.1 gm., thrice daily for five days rest from all drugs two days. Pamaquin 0.01 gm. thrice daily for five days.

This course has in our experience proved much more satisfactory than most of the others that have been tried. Drug resistant cases do occur but they are the exception. Moreover the course is shorter than the original quinine courses, an important matter on active service.

In March last our Director General called another meeting of consultants and research workers in the whole field of anti malarial measures and it was agreed that the standard treatment should not be altered. It was further agreed that on the completion of the course a patient should five days after completion be placed on suppressive doses of mepacrine if he was in a hyperendemic area. On the other hand in other areas ten days after completion of the standard course he should be given a course of mepacrine 0.1 gm. thrice daily for five days to prevent relapses.

Certain variations in the course become necessary for example -

- 1 If quinine runs short, mepacrine will have to be substituted.
- 2 Intravenous quinine may have to be given for cerebral malaria, malarial dysentery with dehydration and a high rate of parasites per red blood cell.
- 3 In the Middle East instances are reported of acute hæmolytic and hæmoglobinuria which resemble blackwater fever very closely. These have occurred in both proved and clinical benign tertian infections. This complication has always occurred during the latter part of the pamaquin course and the mortality was 100%. However, it was found that by adopting the following modifications, although cases continued to occur the mortality was nil.

(1) By keeping the urine alkaline throughout the course. This was best done by giving sodium lactate and sodium bicarbonate.

(2) By not giving pamaquin until four days after the mepacrine course.

(3) By giving pamaquin after meals.

(4) By giving pamaquin 0.01 gm. twice daily for the first two days and 0.1 gm. thrice daily for the final three days.





for pride of place as enemy No. 1. The total number of cases in all areas was Dysentery, 26,380, Malaria, 23,043.

Sulphaguanidine has been largely used in the treatment of the acute forms of bacillary dysentery.

In the Middle East sulphaguanidine is no longer given to the mild Flexner infections, for these rapidly recover without specific medication. For the more severe infections, including the Shiga forms, sulphaguanidine has proved to be of great value and is non-toxic.

During my service in India and Egypt my results with the saline treatment with plenty of fluids together with specific Shiga serum intravenously were very good, but they caused a good deal of anxiety, whereas with this drug the recovery appears to be more rapid. Succinyl sulphathiazole is now under trial.

For the treatment of chronic bacillary dysentery good results have been obtained by retention enemata containing very large doses of sulphaguanidine (see recent articles by Manson Bahr in England and Brewer, Bulmer and Priest, from the Middle East).

**Amoebiasis** — Amoebic dysentery is being treated overseas by a combination of emetine hydrochloride, emetine bismuth iodide, carbarsone or stovarsol, and rectal enemata of quinoxyl controlled by the sigmoidoscope. It is well known that the first symptoms of amoebiasis may be those of hepatic abscess. In the Middle East Force and in others too liver abscess is reported to be frequent in occurrence. Medical officers should make a habit of thinking of amoebic abscess of the liver when a patient with or without a previous history of dysentery gives a story of pain and tenderness in the region of the liver with fever and the physical signs of pleurisy or localized pneumonia at the right, or — less frequently — at the left base of the lung.

The profession at home should think of amoebic hepatitis when soldiers who have been overseas in a sub-tropical or tropical country present the same clinical features.

When amoebiasis is discovered it should be treated *adequately*. The acute, initial form and amoebic hepatitis must receive a full course of emetine hydrochloride injections, followed by the rest of the regime.

When a patient, from a tropical country presents a mass in any part of the large bowel, associated with a varying period of ill-health and irregular diarrhoea, amoebiasis should be considered. This forethought will perhaps save a surgical operation for the removal of a supposed tuberculous or carcinomatous mass in the large intestine.

Some of the material for my address has been derived from the official reports made by our consultants in tropical medicine overseas to our Director General to whom my acknowledgments are duly made.

## DYSENTERY IN THE EUROPEAN THEATER OF OPERATIONS

COLONEL WILLIAM S. MIDDLETON, U.S. ARMY

*Chief Consultant in Medicine, European Theater of Operations*

In the interest of perspective, a chart on the diarrheal diseases has been prepared from data appearing in the 'History of the Medical Department of the United States Army in the World War'. By comparison with the figures for the Civil War, the impact of preventive medicine on the morbidity and mortality of diarrheal diseases may be gathered.

### DIARRHEAL DISEASES

<i>Civil War</i>	TOTAL CASES	<i>World War I</i>
1,585,196		24,171
		(If Civil War factors had obtained 2,842,432)
	DEATHS	
44,558		267
		(If Civil War factors had obtained 72,448)

In the interest of accuracy, one detail must be corrected. The statistics for the Civil War offer no such diagnosis as enterocolitis. The inclusion of these patients in the World War group raises the total figure to 92,512. Correlating these total figures with the troops involved, the incidence of diarrheal diseases in World War I would be 3% of the Civil War level. Even more impressive are the figures for mortality. Only 267 died from diarrheal diseases in World War I, contrasted with the alarming figure of 44,558 in the Civil War. If allowance be made for the difference in the size of the two armies, the magnitude of the difference becomes even more impressive in the projected figures. For example, the incidence for the World War I, applying Civil War factors, would have been 2,842,432 instances of diarrhea and the deaths under similar conditions would have numbered 72,448. Whatever construction may be placed upon this data, the improved control and treatment of the diarrheal diseases are reflected in vastly reduced morbidity and mortality.

From this statement, it may be gathered that there are certain reservations relative to the incidence of diarrheal disease in World War I. Here is a limited vista of a widespread picture. July and August of 1918 were unseasonably hot in France. A victorious but green American Army was pressing backward an obstinate and tried German force on the Meuse-Aisne Front. An army in retreat has neither time nor inclination to provide for the health and comfort of

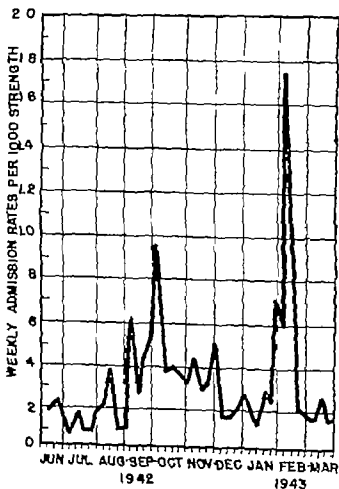
a pursuing enemy. The attacking army is compelled perforce to cross and occupy polluted soil abandoned by the enemy. In turn, neither time nor opportunity is given to prepare adequate sanitation. Latrines are improvised or dejecta deposited indiscriminately in the area. Flies abounded in unbelievably multitudinous numbers. Molasses was the only sweetening for coffee and spread for bread. Each application resolved itself into a race and swarms of flies fresh from the uncovered latrines or worse frequently won. The truth of the matter is that the vast majority of soldiers suffering from diarrhea did not report such. Statistics for this period failed by reason of the exigencies of combat conditions and the inability to afford proper bacteriologic controls.

One very pertinent deduction may however be drawn from the experience of World War I. Since typhoid fever and dysentery are

### WEEKLY ADMISSION RATES

### DIARRHEAL DISEASES

U. S. ARMY IN THE UNITED KINGDOM ONLY



similarly spread, it stands to reason that only typhoid vaccine could have spelled the difference between its negligible incidence and the high level of dysentery. Indeed, without such vaccination typhoid fever might readily have decimated the American Expeditionary Force on the Marne, when dysentery was rampant.

Turning to the experience of the past year in the European theater of operations, the chart has been prepared.

Under the nomenclature of the Army, diarrheal diseases and dysenteries are divided as follows.

Diarrhea	Enteritis
Dysentery	
Bacillary	
Protozoal	
Unclassified	

From February 21, 1942, to March 12, 1943, 1,561 instances of diarrhea and dysentery have occurred among troops in the United States Army, 1,407 were classified as diarrhea or enteritis, 813 of them developed between September 5 and November 6, 1942. Etiology was established in only a minority of the patients (110) instances of bacillary dysentery (proved by laboratory methods), 8 protozoal (proved by laboratory methods), and 36 unclassified are included in the total figure. In a word, 154 or 10% of the total diarrheal diseases represented true dysentery, laboratory proved.

Although the problem for this theater to date has been a small one, the several isolated epidemics provide lessons of great importance. The first epidemic occurred in a quartermaster depot, where 21 instances of diarrhea were reported between September 22 and October 5, 1942. Upon a survey of the local situation, the disease proved to be most prevalent in a company with a screened kitchen and the cleanest kitchen personnel. Flies appeared in unusual numbers and upon closer study the latrine facilities were found to be inadequate. Search in near-by bushes found pollution of the ground by feces and a certain of the stools were bloody. The chain from carrier or actual dysenteric subject through flies and food to a susceptible host was obvious. The Flexner type of *B. dysenteriae* was found to be the offending agent.

A second minor epidemic involving 74 soldiers occurred between November 1 and November 27, 1942, when from a single unit 16 patients were admitted to the hospital and 38 treated in quarters for diarrhea. The Sonne type of *B. dysenteriae* was isolated in several instances and samples from the chlorinated water disclosed the same organism. Doubling of the amount of chlorine and boiling of drinking and cooking water controlled this minor outbreak.

A still different mechanism was involved in a sharp outbreak occurring in three units lately arrived in the theater, among whom

54 instances of the disease appeared between January 1 and February 8 1943 Dysentery had occurred among these soldiers in transatlantic passage. The Sonne organism was incriminated. No dysentery occurred in the area aside from the units above cited and there was no further spread in the involved groups after the enforcement of strict mess gear cleansing in boiling water and other sanitary measures.

The sporadic appearance of diarrhea among several members at a Headquarters mess between February 1 and February 23, 1943 involved 15 subjects among whom the Sonne organism was isolated in two Upon a survey of the food handlers at this mess, two were found to harbor a Sonne organism in the stool. It is assumed that these food handlers were carriers and the origin of the infection.

Embodied in these isolated experiences are all the lessons of the military experience in the dysenteries With mobile warfare, particularly in hot weather but under any conditions this hazard will be an increasing one. It is safe to predict that the diagnosis will be less frequently made and less regularly controlled by laboratory studies than in World War I This statement is made not in the light of less adequate laboratory facilities, but in the availability of specific therapy The occurrence of dysentery bespeaks a breach of sanitary discipline. By the same token, all diarrheal and dysentery conditions may theoretically be prevented by strict adherence to sanitary measures, that control the infection at its source Sewage disposal or the disinfection of stools, care of the dishes and eating utensils of the affected patient meticulous cleanliness and care on the part of medical and nursing attendants are first considerations. Explosive outbreaks are usually water borne. Proper chlorination and boiling of the water will prevent or interrupt such a spread. Chemoprophylaxis with the sulfonamides offers promise of specific control of the bacillary type.

Sulfonamides have proved highly effective in the treatment of bacillary dysenteries. Sulfaguanidine and succinyl sulfathiazole are the currently preferred forms but evidence in favor of sulfadiazine in this relation is growing Our experience has been largely confined to the use of sulfaguanidine The recommended dose is 3.5 gm. (52½ grains) every four hours until the stools number less than five daily The dose is then reduced to 3.5 gm. (52½ grains) every eight hours until the stools are normal for four days. In the availability of the newer chemotherapy the older measures of symptomatic support such as

*Footnote.*—In the opinion of most clinicians, sulfadiazine has superseded sulfaguanidine in the treatment of bacillary dysentery The recommended initial dose of sulfadiazine is 2 gm. Thereafter 1 gm. twice a day will be continued until the stools are normal for two or three days. At this level there should not be danger of renal injury but caution may dictate the alkalinization of all patients receiving sulfadiazine. This has not been the rule in the United States Army.

The chemoprophylaxis of bacillary dysentery is suggested by the success of certain isolated experiences. In this relation sulfadiazine may be given as follows Initial dose, 2 gm. and 1 gm. twice a day for five days.

intravenous glucose and plasma should not be overlooked. Anti-dysenteric serum has not been required in the experience in this theater. Singularly, the reports to date have indicated that the sulfonamides are more effective in the Shiga infections than in other types of dysentery. Amebic dysentery has not been an appreciable problem with us to date.

APRIL 1943

## EXPERIENCES IN ANTI-MALARIAL WORK IN R.A.F. IN WEST AFRICA

WING COMMANDER C J HACKETT, R.A.F.V.R.

Geographically the West African areas (Nigeria to Sierra Leone) can be divided into the wet coastal areas of moderately high all-the-year-round air temperatures with high humidity, and the dry inland areas of hot summers and cold winters with low humidity.

In both areas malaria was related to rainfall – the peak incidence occurring about two months after the month in which 4½ in fell.

The chief vectors were the pool-breeder *Anopheles gambiae* in the mid-year and the stream-breeder *A. funesta* occurring later in the year.

### SICKNESS INCIDENCE

During the first year (1941-42) of the R.A.F. in West Africa while quinine suppression treatment was in practice (5 grains daily), the admission rate to hospital from all diseases per 1,000 per annum was over 1,000, mainly due to malaria and, to a much less extent, dysentery. It must be admitted that often suppressive quinine discipline in some units left much to be desired. However, even in units where discipline was fairly good (80-90%) on checking up the same hundred individuals for one year it was found that the annual hospital admission rate was 100% – but 25% had not been admitted to hospital.

The sickness for the next year was reduced to about 500 per 1,000 per annum, in part at least due to the implementation of building, anti-adult and anti-larval schemes. (In 1944 the total annual hospital admissions per 1,000 were about 200 and malaria was several places down in the list of causes. Mepacrine doubtless played a very large part in this reduction.)

### ANTI-MALARIAL MEASURES

#### (A) Defensive or Initial Measures.

These were naturally of greatest importance.

- (i) *Protective clothing* – With short-limbed garments there is always the difficulty of getting personnel changed by sunset, especially men detained on duty. American and Australian

Armies insist upon slacks and long-sleeved shirts being worn throughout the day. These clothes also reduce abrasions and septic infections.

- (ii) *Bed nets* — Box type is most economical of material and most satisfactory.  
Native troops on aerodromes should also use nets — many will do so to get relief from mosquitoes. In a village 400 yards from one aerodrome the anopheline count per room was over 500 and culicines were also present.  
All patients in hospitals in malarious areas must have nets down at sunset.
- (iii) *Suppressive therapy* — At evening meal for convenience, under supervision of orderly N C O. For Officers and senior N C O.s a nominal roll to be initialled daily by each individual.  
When changing from quinine to mepacrine suppression there must be a three weeks overlap otherwise there will be break through (mepacrine suppression, following Fairley's work, has now completely displaced quinine).
- (iv) *Pyrethrum spraying of accommodation at night* — Of limited value unless accommodation is mosquito-proofed. Offices, work shops and transport should be sprayed in early morning where vector rests in houses.  
Simple type of sprayers are least trouble, i.e. flatguns. (Now D.D.T. residual spraying is in use.)
- (v) *Repellents* — Service issue, paraffin base, was not effective and was extremely unpleasant to use. New preparations of pyrethrin and non-greasy bases were under test. (Now dimethylphthalate fulfils this need.)
- (vi) *Mosquito-proofing of accommodation.* — First priority should be night offices recreation rooms and hospitals. Sanitary annexes should be joined to living accommodation and kitchens to messes all proofed, by proofed covered ways.  
Gauze 16 mesh No 28 I.S.W.G. giving aperture of 0.0477 in. and an air space of 58% to be used.  
Proper planning of buildings for screening is essential. Mud and thatched buildings can be proofed if squared timber is used on which to mount the gauze.  
Self-closing doors, maintenance and discipline are essential.
- (vii) *Siting of stations* — Away from native populations and vector breeding places. Control any native settlement near by. Reduce to minimum natives living on stations no native families permitted.
- (viii) *Early morning pyrethrum spraying of native houses* — Especially during natural transmission season if vector rests in houses.



Must be properly supervised (Now D D T residual spraying is in use)

- (ix) *Adequate curative therapy* — Service personnel lack the immunity, resulting from repeated previous infections, possessed by local European residents
- (x) *Adequate canteen, recreational accommodation and facilities including cinemas* — When a station is anti-malarialized all ranks should be confined to camp at night unless they are visiting known protected areas. Stations should provide outlets to minimize this possible hardship
- (xi) *Anti-malarial supplies and equipment* — These should accompany units into the field
- (xii) *Education of all ranks* — Before and after embarkation it is essential to bring home to commanding officers their responsibilities as laid down in King's Regulations regarding the health of personnel under them. Unflinching support from the highest executive staff officers is essential and disciplinary action against those failing to maintain adequate protective discipline then follows automatically.

#### (B) *Offensive or Final Measures*

Treatment of surface water must give place to removal of surface water as much as possible on account of cost and difficulties in transport of oil and paris green (D D T emulsions avoid this difficulty)

Anti-malarial drainage should be planned, along with storm-water drainage at earliest stage of construction. Value of contour drains, where indicated, needs stressing

In some areas cost and extent of work must be balanced against strength of unit to be protected. It is essential that close co-operation between malariologist and engineers be maintained

Anti-malarial personnel must be specially annotated and protected from misemployment

Half a mile of anti-larval measures is probably adequate with all vector species — but this may be upset by

- (i) Massive breeding just outside area
- (ii) Vector carriage by prevailing wind
- (iii) Migratory flights of some vectors, e.g. *A. elutus*

Bad engineering and borrow pits are still in existence. Earth borrowing must be across contours

(D D T air spraying is now coming into use)

#### GENERAL CONCLUSIONS

In a hyperendemic area protective clothing, bed nets and suppressive quinine (5 grains) cannot be relied upon during peak of malarial transmission

The most dangerous times of the day are after the evening meal

until bedtime and at dawn during toilet and dressing until breakfast in areas where vector rests in houses.

To cover these, there must be proofing or anti larval measures (now mepacrine has given added protection and anti larval and anti adult measures are instituted as early as possible)

If military operations are intended in an hyperendemic malarious area during the malarious season, it would be most wise to bring in fresh personnel immediately before the operation. Personnel infected with malaria, but able to carry on static routine duties under suppressive quinine therapy would probably develop extensive clinical malaria if subjected to unusual strain. Operations should if possible, be planned for the off-season of malarial transmission (Campaigns in South West Pacific and South East Asia, etc., have demonstrated the truth of this, but they have also demonstrated the value of 0.1 gm. mepacrine daily, after an adequate body content has been reached, in reducing malaria including malignant forms and blackwater fever)

DECEMBER 1944

## NUTRITION IN BELGIUM AND HOLLAND DURING THE GERMAN OCCUPATION AND SINCE THE LIBERATION

SQUADRON LEADER SIMON YUDKIN R.A.F

The observations presented were made jointly by Wing Commander T F Macrae S/Ldr G A. Smart and myself during a visit to R.A.F units in Belgium and Holland in September and October 1944. We were greatly helped by numerous doctors and other scientific workers, and by many Belgian and Dutch citizens holding official appointments.

### I — BELGIUM

(a) *Standard of feeding* — Official rations fluctuated little throughout the period of occupation, nor has there been much change since the liberation. The main allowances are shown in the table. Vegetables other than potatoes were unrationed and were usually easily obtained. Fruit was unrationed but most of the country's stocks were requisitioned by the Germans. Milk was reserved for pregnant women, children, adolescents the aged and those suffering from tuberculosis it was usually partially defatted. Bread was of poor quality consisting mostly of 97% extraction rye flour it never contained more than 30% of wheat flour, and barley beans, potatoes and sugar were put into the flour from time to time. Several other foodstuffs were also of poor quality. The total caloric value of the rations, together with the usual amount of unrationed goods available, was 1,500-1,700 calories daily

An extensive black market developed during the occupation which provided extra food for the major part of the population, there is no doubt that it was an essential factor in preventing widespread and gross starvation. The food procured in this way would otherwise have been requisitioned by the Germans, so that many law-abiding citizens felt no compunction in obtaining food illegally for their essential requirements. The price of rationed goods was not exorbitant but black market goods were very expensive, meat, butter, eggs and palatable foods in general being much more expensive than, for example, white flour or sugar. Practically the whole of the earnings of the middle and lower economic classes was spent on food.

The food position was worst in the winter of 1940-41 and the spring of 1941. Many of the rationed goods were not available and the Germans requisitioned most of the Belgian potato crop to supplement their own poor crop. From 1941 the position improved gradually until March, 1944, but has deteriorated since with no improvement after the liberation.

(b) *Effect of feeding on health* - Gross signs of deficiency were noted mainly in 1940-41 and especially amongst those who could not supplement their rations. Classical deficiency diseases did not occur more frequently than before the war. Loss of weight was marked, most people losing about 5 kilos, and some up to 25 kilos. Famine oedema was not uncommon in 1940-41, but there have been fewer cases since. It was usually preceded by polyuria and this was also a common symptom amongst the general population, not necessarily followed by oedema. Hypoglycæmic coma without convulsions also occurred in a few emaciated subjects. Low blood pressure and bradycardia were very common.

Skin sepsis and dryness of the skin were widespread amongst all groups of the population. Peptic ulcer and hernia were said to have become more common, but all agreed that non-nutritional causes were largely responsible for these increases. Umbilical hernia was more frequent amongst children.

The basal metabolic rate of many people dropped by 10-15 % during the period of the worst restrictions, and in thyrotoxic subjects this was accompanied by an alleviation of symptoms.

It was widely agreed that tuberculosis had become more common but the exact amount of increase cannot be defined for various reasons. (1) Tuberculosis became notifiable during the occupation. (2) The fact that people with tuberculosis received extra rations and often a prolonged rest in a sanatorium induced many people to report to clinics. (3) Mobile dispensaries with X-ray facilities were set up during the war and many new cases were discovered in this way. The death-rate from tuberculosis shows an increase of about 50 % in 1941-42 compared with 1939-40. It was frequently remarked that the

cases occurring in 1941 followed a rapid downhill course and were less amenable to treatment.

The efficiency of the workpeople was of course low but nobody attributed this entirely or even primarily to underfeeding. In the field of obstetrics it was found that the weight increase during pregnancy was often only about 6-7 kilos instead of the normal 14 kilos. Premature births and puerperal sepsis were not more common, but the weight of newborn babies was slightly less than before the war in multiparae at least. Diseases of the newborn were not more common.

Many of our informants were worried about the present state of affairs. People are beginning to lose weight again and polyuria is becoming once more a common symptom.

(c) *Personal observations October 1944.* - The striking feature about the food was the preponderance of vegetables and cereals and the shortage of meat and fats. It must have been very difficult to prepare palatable meals with the food available.

The nutritional status of the children we examined was on the whole not too bad. The weights and heights of the younger children were not different from those obtaining before the war but the older children were both shorter and lighter than normal. About half of the children showed dryness of the skin with powdery desquamation on the limbs and sometimes on the trunk where the skin was tense it was often shiny and crackled. Rather fewer of the children showed follicular hyperkeratosis of some degree the dark adaptation of these children was however normal and the vitamin A and C content of their diet had been and still was very high. Another common abnormality was skin sepsis with poor healing of minor cuts and scratches and this did not seem to be due entirely to lack of washing facilities. Other signs noted were poor muscle tone and consequent potbelly especially in the younger children and umbilical hernia persisting in children beyond infancy. There were no signs of rickets or scurvy and corneal vascularity was not especially prevalent. The few adult workers who were seen had lost a good deal of weight but there were few other signs of deficiency.

## II - HOLLAND

For military reasons we were not able to investigate the position in Holland in much detail. The doctors and others we met in Eindhoven all considered that food conditions were critical. Basic rations had been similar to those in Belgium but the black market was less extensive as control was much stricter and food was scarcer. As far as the health of the population was concerned, the information was similar to that given to us in Belgium although the weight loss had apparently been more severe. Our own observations were limited but they confirmed that the position in Holland was worse than in Belgium.

In conclusion we should like to thank Air Marshal Sir Harold Whittingham, K.C.B., K.B.E., K.N.P., who made this investigation

possible and Colonel Stirling (R A M C), 21 Army Group (Civil Affairs), Major DeVel (M C, U S Army), S H A E F Mission to Belgium, and Captain Hennebert (R A M C), Belgium Military Mission (Civil Affairs), through whose good offices meetings were arranged with most of our informants

TABLE - AVERAGE OFFICIAL RATIONS IN BELGIUM DURING  
GERMAN OCCUPATION

<i>Item</i>	<i>Weight</i>	<i>Frequency</i>
Bread	250 gm	daily
Potatoes	500 gm	daily
Meat (with bone)	30 gm	daily
Butter	200 gm	monthly
Margarine	100 gm	monthly
Sugar	1,000 gm	monthly
Jam	450 gm	monthly
Dried peas	200 gm	monthly
Cheese	100 gm	monthly
Herrings	1,000 gm	weekly during Oct - March (in larger towns only)

JANUARY 1915

## TROPICAL DISEASES WITH SPECIAL REFERENCE TO MALARIA IN THE EASTERN THEATRES OF WAR

BRIGADIER N HAMILTON FAIRLEY, C B E

*Director of Medicine, Australian Military Forces*

The incidence and risk of infection with tropical diseases in the South West Pacific and South East Asia Commands appear to be very similar. Amœbiasis has not been a problem in S W P A, sprue has been rarely encountered in troops there and kala-azar not at all. Otherwise the medical experiences on the two fronts appear to have had much in common. Under such circumstances, and in view of the limited time at my disposal, my remarks will be largely confined to the South West Pacific.

In jungle warfare far more casualties arise from disease than from enemy action. The experience of the 2/22nd A I F Battalion after their escape from Rabaul shows what happens to a force deprived of anti-malarial drugs in highly malarious areas in the S W P A. Despite the fact that a certain quantity of quinine had been available during the early stages of their retreat across New Britain, 50 out of 252 troops died from M T malaria within five weeks of the supplies of quinine becoming exhausted.

During the earlier New Guinea campaigns casualties from sickness

were 5 to 30 times as common as battle casualties, and malaria and dysentery proved a more serious menace than the Japanese. For this reason it became necessary to instruct every soldier how to avoid disease in the jungle, especially as most of these diseases were avoidable. Training in tropical hygiene now constitutes an integral part of training for jungle warfare.

Owing to the numerous diseases transmitted by biting insects, the clothing of the soldier in the jungle becomes of major importance. Shorts are dangerous for though they are cool to wear they increase the surface area of exposure to trauma and insect bites, increase the incidence of tropical ulcers, septic sores, dengue, filariasis and malaria and prevent the effective application of anti mite fluid for the prevention of scrub typhus. Trousers gaiters and long-sleeved shirts or jackets are essential in jungle warfare.

An analysis of the types of sickness casualties during six months campaign in the Huon Peninsular and the Markham-Ramu Valley Campaign in 1943 is shown below -

Malaria	60.5%
Dengue	17.5%
Dysentery and Diarrhoea	6.5%
Scrub typhus	2.5%
Skin and other diseases	13.0%

The ratio of sickness to battle casualties was approximately 16 : 1

### I - BACILLARY DYSENTERY

Bacillary dysentery has been the most frequently encountered disease transmitted by infected food and polluted water. Human carriers and flies are important factors in the dissemination of this disease. In the Middle East, fly transmission was the common mode of spread. In the South West Pacific and Netherlands East Indies infection by polluted water is common; this is due to the natives habit of defecating directly into streams and rivers.

Early in 1941 in the Middle East, 30 lb. of sulphaguanidine were sent to Colonel G. A. H. Buttle by Professor Marshall of Baltimore. Colonel J. S. K. Boyd and the author investigated its therapeutic value, limiting observations in the first instance to severe cases of bacillary dysentery where the organism had been isolated. Shiga infection was specially studied as this was the only form of dysentery liable to be fatal. Our findings which were reported in 1942, proved conclusively that sulphaguanidine was a specific cure for Shiga dysentery as well as for the milder dysenteries of Flexner-Boyd type. Owing to the necessity for identification of the organism in the early cases investigated it was generally not feasible to give the drug until the 3rd or 4th day of the disease. As anticipated later experience in New Guinea showed that the administration of sulphaguanidine in

adequate dosage within a few hours of onset resulted in a dramatic cessation of the diarrhoea, the early production of normal stools and rapid cure. In such cases the disease is practically aborted since multiplication of dysentery bacilli is terminated before the colonic mucosa is seriously damaged. Convalescence is correspondingly shortened and many cases are cured without needing to be admitted to hospital. Several results have followed the widespread use of sulphaguanidine in adequate dosage in the field and in hospitals in New Guinea.

- (1) The admission rate to hospital has been markedly lowered
- (2) The disease appears to be changing its character or disappearing; this is indicated by the fact that it is now only possible to isolate dysentery bacilli in approximately 10% of diarrhoeal cases admitted to hospital
- (3) The mortality rate in the last 10,000 cases has been 1 in 5,000

More dramatic evidence of its value from a military view point was obtained during fighting over the Owen Stanley Ranges on the Kokoda trail in 1942, when severe dysentery broke out in Australian troops. Japanese troops were at this time dying from dysentery and both forces had of necessity polluted the area in the immediate vicinity of the narrow jungle trail, along which successive advances and retreats were being made. As the epidemic increased in severity grave concern was felt regarding the dysentery casualties in the Australian Forces. At this juncture all the available reserve of sulphaguanidine in Australia was rushed by air to Moresby and transported to the forward area, where all troops with diarrhoea were immediately treated. At each regimental aid post (R.A.P.) established along the trail at intervals of a few miles, sulphaguanidine in doses of 4 gm (1 drachm) was administered to troops with diarrhoea or dysenteric symptoms. The result was remarkable. Within ten days the epidemic was completely controlled, and subsequently the incidence was reduced to the number of sporadic cases preceding the epidemic. Here, sulphaguanidine acted by breaking the vicious circle. It reduced the number of stools, rapidly controlled the diarrhoea, and so limited the area polluted, by inhibiting the multiplication of dysentery bacilli in the stools, *B. dysenteriae* was either eliminated or so greatly reduced in number that infectivity was minimal. It was the considered opinion of many officers that sulphaguanidine saved Moresby.

It is not proposed here to assess the relative merits of the different sulphonamides in the treatment of bacillary dysentery. Sulphaguanidine has to be given in large dosage and is expensive. On the other hand, it has proved to be absolutely safe for field use. In the thousands of cases of dysentery for which it has been used in New Guinea, no instance of

anuria has been reported even though patients have been dehydrated in the initial stages of treatment, nor has agranulocytosis or exfoliative dermatitis been encountered. Deficiency diseases have been very rare and steatorrhoea of sprue type has been conspicuous by its absence in troops in New Guinea. No increase in the incidence of these diseases has followed the widespread use of sulphaguanidine in the field. Rarely headaches, nausea, mild erythematous or maculopapular rashes with or without slight fever have occurred but toxic manifestations of any real severity have been absent. When it be remembered that the mortality in New Guinea from bacillary dysentery treated with sulphaguanidine is 1 in 5,000 one has to be very sure not to add to it by substituting a more toxic drug. The disadvantages of sulphapyridine, sulphathiazole and sulphadiazine are their toxicity and especially their tendency to produce anuria in dehydrated patients. It would be taking an unwarranted risk to hand out these sulphonamides to troops in the jungle with diarrhoea when they are not under medical supervision - at least that is the considered opinion of the Medical Directorate at Land Headquarters, S.W.P.A. Should the diarrhoea be caused by *E. histolytica* or some aetiological agent other than *B. dysenteriae* a preliminary course of sulphaguanidine does no harm, for where the response to this treatment proves unsatisfactory the soldier is automatically sent to a casualty clearing station or general hospital where the cause of his persistent diarrhoea can be investigated and appropriately treated.

## II — AMOEBIASIS

Amoebiasis has not constituted a problem in the S.W.P.A. as it has in S.E.A.C. its incidence has been low and relapses infrequent. It has not been responsible for more than 5 to 10% of cases of dysentery. Adequate supplies of emetine-bismuth iodide have always been available in the forward areas, and the use of emetine injections has been mainly restricted to amoebic hepatitis and amoebic abscess. In dysentery emetine injections were discouraged except in the treatment of the primary attack.

Standard treatment consisted of a ten day course of emetine bismuth iodide (3 grains) administered in gelatine capsules on an empty stomach, while retention enemas of chiniofonum (yatren) were given each morning. This was followed by a seven day course of carbarsone.

When hepatitis or liver abscess was present a ten day course of emetine injections were given (1 grain daily) and this was followed after two or three weeks by the standard course of E.B.I. treatment outlined above. Not more than three deaths from proven amoebiasis have been recorded in the Australian military forces, perforation of the colon (one case) and liver abscess (two cases) being the cause.



## III — SCRUB TYPHUS

Scrub typhus is the only tropical disease which is killing troops with regularity in the S W P A, the overall case mortality rate being about 8 per cent. Considerable variation in the mortality rate is found in different areas, the range being from 0-30%. Thus the mortality was very low on the Australian Mainland and at Milne Bay, and much higher over the Owen Stanley Ranges and on the northern shores of New Guinea. This appears to be due to variation in virulence in the strain of rickettsia rather than to variable dosage.

It is transmitted by the bite of larval trombiculid mites such as *Trombicula deliensis* (Walch), harbouring *Rickettsia tsutsugamushi*. Field mice and rats are known to be natural hosts.

*Prevention* — (1) *Anti-mite fluid* Both dimethyl phthalate and dibutyl phthalate afford protection against scrub typhus.

In the Australian Army individual treatment of clothing is carried out with dibutyl phthalate which kills but does not repel mites. Dibutyl phthalate is used in preference to dimethyl phthalate not because it is a more effective mite larvicide, but because in New Guinea McCulloch found its larvicidal effect persisted longer in clothing after immersion in water and after washing. When wearing treated clothing (socks, trousers and shirt) it is possible to lie down in country swarming with mites without getting a single bite. Complete protection against scrub-itch as well as against scrub typhus is thereby attained. When clothing is removed at night it is essential that the blankets be treated if mite bites are to be avoided. Mites causing scrub itch are not necessarily concerned with mite typhus.

(2) *Delimitation of infective areas* In the S W P A scrub typhus appears to be restricted to small areas of high infectivity often widely separated from one another. Not infrequently, infective areas occur in association with jungle-fringed streams. It is important to get immediate notification of typhus cases and for suspected areas to be delimited and put out of bounds to troops immediately if this be feasible.

*Treatment* — No specific treatment is available. The sulphonamides and penicillin are only useful for secondary bacterial complications.

## IV — DENGUE

In the tropics and sub-tropics the rapid spread of dengue and the fact that it may prostrate a large proportion of a force makes it formidable from a military viewpoint. Though the disease is non-fatal, it may incapacitate the victims for three weeks or longer.

The common mosquito vector was first experimentally demonstrated in Australia by Cleland, Bradley and MacDonald (1916, 1918) to be *Aedes ægypti*. Later, in the Philippines, Simmons (1931) showed that *Aedes albopictus* transmitted the disease. *Aedes scutellaris* was recently

proved to be a vector in New Guinea (1944) by Army investigators working under Lt. Col. Mackerras A.A.M.C. The density of this mosquito in and around camp sites was found by Berrill and other Australian Army entomologists to be approximately directly proportional to the number of cases of dengue occurring in that particular area. In breeding *Aedes scutellaris* prefers clean rain water with or without the addition of a few dead leaves. Larvæ breed in rusted tins, old coconut shells the tops of oil and petrol drums, and in the axils of the limbs of mango trees. The adults were found to enter tents and huts at approximately 7 to 8 a.m. and 4 to 7 p.m. On overcast days, however mosquitoes of this species entered and were liable to bite all day long. During the day they appear to rest in cool damp well shaded situations under growing shrubs and bushes, well protected from the rain. Their flight range appears limited to a few yards.

*Experimental transmission to man* - Mosquitoes of four different species were fed in the Finschafen area New Guinea, on dengue patients during the first two days of dengue fever and subsequently flown to Sydney where dengue does not occur. The mosquitoes were kept at the Zoological Department University of Sydney and the Volunteers at 113th Australian General Hospital under the medical care of Captain P. G. Dowling. Three volunteers receiving 32-82 bites from *Aedes scutellaris* over a period of from nine to fourteen days, each developed clinical dengue characterized by a saddle-back type of temperature and rash. On the other hand three other volunteers bitten by *Armigeres braini*, three bitten by *Armigeres malensis* and two bitten by *Aedes excrucians* failed to develop the disease. The infection was also transmitted by subinoculation from the cases bitten by *Aedes scutellaris* to three new volunteers, and from them in turn to four other volunteers. Finally the original volunteers, who had developed dengue after being bitten by *Aedes scutellaris* showed no response on subinoculation of blood containing dengue virus. This demonstrated they had acquired immunity from their original attack.

*Prevention* - No drug at present available will affect the course of this disease and no prophylactic vaccine is known. However, in New Guinea during an epidemic it was found that much could be done by

- (1) Eradicating breeding places in and around camps.
- (2) Destroying adult mosquitoes by spraying tents and huts especially in the morning (8 to 9 a.m.) and later in the afternoon (4 to 7 p.m.)
- (3) Wearing protective clothing and applying repellent lotion during the daytime.
- (4) Keeping all febrile patients throughout the day and night under mosquito nets.

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Once a force has been exposed to an epidemic of dengue, sporadic cases may subsequently crop up from time to time, but they only become numerous if large numbers of non-immune reinforcements have been introduced

### V — MALARIA

Troops generally contract both malignant and benign tertian infections when jungle fighting in New Guinea. During active operations they have broken down with the dangerous malignant tertian malaria (*P. falciparum*) and after treatment in hospital have later relapsed with *P. vivax* infections which had not been cured. Throughout the Milne Bay and Buna-Gona campaigns in 1942, malaria casualties far exceeded battle casualties, the hospital admission rate in three to four months almost equalling the total strength of the forces involved. In these campaigns suppressive treatment consisted for the most part of quinine (10 grains) daily. Later, in 1943, there were very heavy malaria casualties in the Ramu and Markham Valley and the Huon Peninsular campaigns, when the suppressive drug regime consisted of 0.1 gm of atabrin daily on six days of the week.

So serious was the malaria position that in 1943 it was decided by the C-in-C, on the advice of the D G M S, to create a research centre in Northern Queensland to investigate the precise value of all known anti-malarial drugs. A medical research unit was formed comprised of medical specialists, entomologists, parasitologists and biochemists, and 500 volunteers were soon forthcoming from the Army. The plan was to expose volunteers taking a specified daily dose of a given anti-malaria drug to bites of mosquitoes infected with *P. vivax* or *P. falciparum* parasites. Volunteers took the drug before, during and for twenty-three days after exposure to infection. The latter figure was selected as it constituted the upper limit for the ordinary incubation period for primary M T and B T malaria.

Time will only permit brief summary of the findings in volunteers infected with New Guinea strains of *P. vivax* and *P. falciparum* when taking quinine or mepacrine (atabrin).

### QUININE

*Malignant tertian malaria* — When volunteers, who were taking 10 grains of quinine daily, were exposed to ten infective bites by mosquitoes (*A. punctulatus* var *typicus*) harbouring sporozoites of *P. falciparum* in their salivary glands, they invariably developed overt malignant tertian malaria with fever, splenomegaly and parasites in the blood within the usual incubation period. When the dosage of quinine was increased to 30 grains daily the fever was rapidly controlled and generally parasites disappeared in three days.

*Benign tertian malaria* — In volunteers exposed to ten bites of anophelines infected with *P. vivax*, 5 grains of quinine daily were

found inadequate to suppress overt attacks of benign tertian malaria. When the dosage was increased to 10 grains daily in another group of volunteers suppression was satisfactory in two-thirds of the cases. In view of the complete failure of quinine to suppress M T malaria and its partial failure to suppress benign tertian infections, it is evident that the heavy malaria casualties in the Milne Bay and Buna-Gona campaigns could not have been prevented by suppressive quinine in a dosage of 10 grains daily even if it had been taken regularly which is very doubtful. As quinine in a dosage of 10 grains daily is the maximum daily dose that can be tolerated over any lengthy period it was evident that this drug was not a satisfactory suppressant for New Guinea strains of *P. falciparum* or *P. vivax*.

#### ATEBRIN

Results quite beyond expectation were however obtained in volunteers receiving 1 tablet (0.1 gm.) of atebirin on six or seven days of the week for four weeks prior to exposure to infection, during the period of exposure and for twenty three days after the last infective bite. Controls not taking drugs who were bitten by the same number of infective mosquitoes from the same batch invariably developed malaria.

*Benign tertian malaria.* - Volunteers exposed to bites of mosquitoes infected with *P. vivax* did not develop attacks of overt malaria when receiving atebirin with unvarying regularity in the above dosage. Unfortunately clinical malaria associated with parasites developed later fever appearing in fourteen to forty four days, and parasites from nineteen to forty-six days after drug administration ceased.

*Malignant tertian malaria.* - Similarly volunteers exposed to 10 to 21 infective bites (*P. falciparum*) failed to develop overt attacks of malaria when following an identical suppressive atebirin regimen. Mild clinical features associated with a slight transient rise in temperature, fleeting aches and pains and perhaps some tenderness on temporary enlargement of the liver and spleen were noted, but in no instance were symptoms sufficiently severe to necessitate bed rest and the volunteers invariably carried on their routine activities. In such cases parasites were not demonstrable though 1 to 2 c. mm. of the blood were examined in thick films. Furthermore after cessation of drug treatment overt malaria failed to develop. Inoculation of fresh volunteers with 200 c.c. of their blood failed to produce malaria infection in the recipients and susceptibility tests invariably showed the original volunteers were capable of developing malaria when they were injected with blood containing M T parasites.

The continued absence of fever and demonstrable parasites, the failure of subinoculation to transmit malaria and the final demonstration of susceptibility constituted a chain of evidence indicating that malaria

infection had been either prevented or cured. Early subinoculation from the seventh to the tenth day, however, revealed parasites in the blood even though they could not be demonstrated microscopically. It is, therefore, evident that in malignant tertian malaria atebryn is not acting as a casual prophylactic, but is curative by schizonticidal action, destroying the young asexual parasites as they appear in the circulation (presumably from schizogony of early e.c. forms) on the seventh day following infection.

*Mixed infection* – Reference has been already made to the fact that in jungle warfare troops become infected with both *P. falciparum* and *P. vivax*. To reproduce field conditions experimentally, it was necessary to infect volunteers repeatedly by exposure to different batches of infective mosquitoes harbouring *P. vivax* or *P. falciparum* over a period of several months. In addition it was essential to subject volunteers to conditions which favour malaria relapses such as physical fatigue, cold, anaemia, blood loss, etc. All this was done, but in no instance did overt malaria develop while they were taking atebryn. On an average of thirty days following cessation of drug administration, however, volunteers developed overt benign tertian malaria. Parasites of *P. falciparum* were never found. These experiments were of profound significance from a military point of view for they proved that, provided troops took atebryn in adequate daily dosage as laid down in standing routine orders, it was possible for them to go into hyperendemic areas of malaria and fight for indefinite periods in the jungle without significant malaria casualties. There would be no deaths, no malaria carriers and no blackwater fever – always provided the daily dose was continued for three to four weeks after leaving the endemic area. After stopping atebryn troops infected with latent *P. vivax* would develop overt benign tertian malaria.

#### FIELD EXPERIENCE

In the Australian Army questions were continually being raised by field commanders and staff officers regarding (1) the efficacy of anti-malaria measures advocated by the Medical Directorate, and (2) whether suppressive or prophylactic drugs could control the repeated malaria infections contracted in jungle warfare. The experiments as outlined above were devised and undertaken to get pertinent data which would answer the latter question. These data, which were presented to the Australian Army General Staff and Field Commanders at the Atherton Conference, were officially accepted as proving that a correct atebryn regimen would lead to the control of malaria in hyperendemic areas and enable troops to fight on with a minimum of malaria casualties. Subsequently, knowledge regarding atebryn administration and personal protection became an essential part of a soldier's training for jungle warfare, and the institution of anti-malaria measures and atebryn-suppressive medication a matter of strict military discipline.

Following an increasingly efficient atabrin discipline the malaria admission rate to hospitals in New Guinea has fallen almost progressively from 740 per 1 000 per annum in December 1943 to the remarkably low level of 26 per 1,000 per annum in November 1944, despite the fact that many of the troops are still located in hyper endemic areas of the disease. A number of factors besides atabrin have contributed to this result. These include less fighting and static conditions which have enabled more effective control of larval breeding and destruction of adults, etc. and therefore less fresh malaria infections. Many of these troops, however have chronic benign tertian malaria and the infrequency of malaria relapses shows conclusively that atabrin is the dominant factor in maintaining the hospital admission rate at so low a figure.

JANUARY 1945

## MALARIA IN THE EASTERN THEATRES OF THE WAR

BRIGADIER J. M. TWHIGG D.S.O., E.D., A.D.M.C. (U.K.)

Control of malaria is a military rather than a medical problem. It is not the function of the medical services to see that control measures are carried out - that is a job for the C.O. and officers of the unit - but it is the job of the medical services to ensure that units are instructed in these matters. I would not say they even have to do the instructing but they must supervise it and should see that it is done properly and take some active part in it - in the shape of lectures to officers and potential demonstrators. It is a usual practice to produce a booklet to form a basis for the instruction of officers and N.C.O.s and it is the duty of the latter to impart the contents to the men under their command. Such booklets contain notes on the disease itself show how it is transmitted give details of personal protection suppression with atabrin, methods for mosquito control and the organization which has been set up to carry out control measures. It is wise to include in the booklet the Standing Orders for Malaria Control, including regulations about dress, the use of nets and the taking of atabrin, and these should be explained frequently by officers to their men.

Attention should be directed to circumstances where precautions are likely to be overlooked, e.g. night manoeuvres, night alerts visiting latrines at night or in the morning, showering or bathing and evening entertainments. Routine early reveille should be avoided. Policing by unit anti-mosquito squads forms part of the routine. The average soldier will co-operate well when he understands from his officers what



it is all about and why certain measures are to be adopted or why restrictions are imposed on him

These are simple details but they are important and are the essence of the problem. Should a high sickness-rate occur in any unit from controllable diseases, then the commanding officer should be called upon for an explanation.

We have closely followed the methods advocated by Brigadier Hamilton Fairley.

The story of the part of the New Zealand Land Forces in the South Pacific campaign is briefly as follows.

Following upon landings by the U.S. Marines on Guadalcanal in the middle of 1942, the situation was not too happy, and, in August 1942 New Zealand offered a division to assist the U.S. Forces. A garrison force, consisting of two brigades, which had recently been withdrawn from the Fiji Group, formed the nucleus of the force.

The New Zealand Expeditionary Force in the Pacific went initially to New Caledonia, where it relieved the American division to enable the latter to proceed to Guadalcanal. The New Zealand force came under the command of the Commander, South Pacific Area, and was kept in New Caledonia in a defence and training role.

In August 1943 the third New Zealand division was transferred to Guadalcanal, and, on the way, carried out combined operational training as an amphibious force in the New Hebrides. With Guadalcanal as a base, operations were conducted on the islands of Vella Lavella, the Treasury Group and Nissan, these operations being in the nature of assault landings in co-operation with the United States Navy and Air Force and elements of the R.N.Z.N. and the R.N.Z.A.F.

During the months May to July 1944 the force was withdrawn to New Caledonia and thence to New Zealand. The paramount reason of this was the shortage of man-power in New Zealand.

*Handling of a force coming out of a malarious area* - New Caledonia is non-malarious but the islands of the Solomons Group are highly malarious and malaria had reached high proportions in the forces engaged in operations there. During the training period, the opportunity was taken to send the Consultant in tropical diseases, Colonel Sayers, to Australia and New Guinea. This officer had had eight years' experience in the Solomons in mission and other hospitals. The assistance given by the medical services of the Australian Forces, and by Brigadier Hamilton Fairley in particular, is duly acknowledged and contributed in no small measure to any successes we achieved in the combating of the disease.

From the story of the U.S. Marines on Guadalcanal and the early experiences of the New Guinea campaign we anticipated, and provided for, a malaria incidence of 100 per month per 1,000 men in the combat area. Every effort was made to have all ranks instructed in

anti-malarial measures. No 1 N.Z. Malaria Control Unit was sent to the New Hebrides to gain practical experience under the U.S. malaria control organization. In the islands where the U.S. Forces were established we shared in the benefits of the big engineering scheme carried out by them for control purposes. An example of what was achieved in engineering obtains in Espiritu Santos in the New Hebrides, where, after one year it was found safe to declare this practically a non-malarious area and to discontinue suppressive atabrin.

New Zealand troops followed the standard malarial control measures and were put on a suppressive atabrin of 0.6 gm. per week.

Preventive and suppressive measures in New Zealand troops achieved the following results:

TABLES BASED ON FIGURES COMPILED UP TO DECEMBER 1944

I				II				III			
<i>Number contracting malaria</i>				<i>Number of relapses</i>				<i>Total incidence</i>			
For ward areas	New Cal.	Total	% (+)	For ward areas	New Cal.	Total	% (+)	For ward areas	New Cal.	N.Z. Total	% (+)
155	250	405	2.94	3	55	58	14.32	158	305	218	68.1

(+) This percentage is based on the figure 13,784, i.e. the number entering the malarious area.

(++) This percentage is based on the total number contracting malaria shown in Table I i.e. 405.

NOTE.—Of the 218 cases shown in Table III as developing Malaria in N.Z., the proportion of primary attacks and relapses is not available.

There were no deaths and no complications. Battle casualties were given a dose of atabrin of 0.3 gm. a day for three days.

The treatment of a force on coming out of a malarious area will depend on whether it is to be employed on further operations involving exposure to malarial infection. We have it from Brigadier Hamilton Fairley that atabrin in the ordinary suppressive dose of 0.1 gm. per day should be continued for one month after coming out of a malarious area and that such dosage will be effective in controlling falciparum infections, but the New Zealand force was withdrawn before this instruction was introduced. The force was being withdrawn entirely from malarious areas and was to proceed to New Zealand. Previous experience with United States troops was that they were dropping down everywhere throughout the country after going on leave, so that we followed a scheme whereby men were held in camp for four to six weeks after the cessation of atabrin. It was hoped that the greatest number of cases would occur within that period.

### RATE OF DEVELOPMENT OF PRIMARY ATTACKS AFTER CESSATION OF ATEBRIN

Number of weeks after cessation of atabrin																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	33
Number of cases	15	32	54	62	45	17	8	7	4	1	1	1	1	1	1	1

NOTE.—These figures are based on attacks occurring overseas as N Z figures are not available

A malaria record card was devised to be carried in the paybook of each soldier: this, in addition to giving particulars of suppressive atabrin treatment and records of blood films, contained some general advice for the soldier on malaria and instructions on how to obtain treatment should an attack come on while on leave. A pamphlet on the clinical aspects of malaria, with details of modern treatment, was distributed to every medical practitioner.

MARCH 1945

## INFECTIVE HEPATITIS ON THE ITALIAN FRONT (I)

COLONEL RICHARD M. McKEAN, M.C., U.S. ARMY

*Chief Medical Consultant, Continental Advance Section (U.S.)*

*General* — Infective hepatitis began to manifest itself as a factor of importance to the armed forces of the United States in this war in mid-1943 in Northern Tunisia. The numbers increased steadily through the late summer and fall of that year, spreading across North Africa to the westward, and following our divisions into Sicily and Italy. This mounting incidence continued through November and December, sustained a peak through January 1944, showed a marked decline in February and March, and maintained a low census throughout the spring and early summer. Recent reports from the Italian theater indicate that this same curve has duplicated itself through the fall and early winter just behind us.

The following discussion deals primarily with the observations in one general hospital, on a series of 797 cases of infective hepatitis, during the eight-month period of its function in Italy from November 1943 to June 1944. Many of the conclusions drawn are individual to that group, or crystallized from discussions with members of other medical services in that area. Colonel M. H. Barker, chairman of the Hepatitis Commission in the Mediterranean theater, was a focal point in a number of such conferences, and many of the views which follow, and in which we concur, are essentially his.

*Clinical course.* — In dealing with the overall picture of the clinical course of the disease and its sequels, one is struck by the fact that there is a definite analogy between infective hepatitis on the one hand and

hemorrhagic Bright's disease on the other. In each, there is the acute initial episode with one of several and similar possible eventualities as an aftermath. In the vast majority of instances, a steady and uninterrupted convalescence ensues, with apparent complete healing and a disappearance of the process from any evident effect on the human economy.

There may be, however, a persistence of the disease — either through the obstinacy of the afflicting agent, or through failure — on our part or that of the patient — to allow sufficient time for repair. This corresponds to the *chronic active* stage in Addison's account of renal disease, wherein the disease extends well beyond its usual span, or relapses after apparent recovery. In either circumstance its course may run benignly to burn out eventually and leave no recognizable organic damage in its wake, or it may break suddenly from this smooth course toward apparent recovery (and often without evident reason), to descend a fulminating and rapidly fatal path, clinically and pathologically simulating or identical with, acute yellow atrophy. Theoretically from a long continuance of this chronic active form, with advancing destruction, there may result a typical periportal cirrhosis. This has not been witnessed by us, but the time element has been too brief to evaluate this possibility.

More specifically the course of the disease may be divided into a number of quite clearly marked phases —

(a) *Prodromal period* — A generally sharp onset characterized by fever of moderate grade which may persist for two to four days, chilliness and malaise, headache (particularly retro-orbital) and general muscular soreness associated with the appearance of diffuse, soft, non-tender adenitis. There is a usual leucopenia, with relative lymphocytosis, and commonly from 10-30% of large atypical mononuclear cells, resembling those seen in infectious mononucleosis. The only laboratory evidence of liver changes, at this time, is found commonly in a rising serum phosphatase and globulin and a positive cephalin-cholesterol flocculation test, which may appear in this phase or in that following.

(b) *Interval period*. — About four to six days later, the interval phase sets in. There is a disappearance of acute symptoms, temperature returns to normal and frequently the only residuals are a diffuse abdominal fullness, mild diarrhea or constipation, and anorexia, although a high lumbar backache, with local spasm and muscle tenderness at about the level of the eleventh to twelfth dorsal vertebrae, may be found along with the appearance of a moderately enlarged, tender liver. Herpes labialis and urticaria appear in some 10-15% cases (Barker). At this time there is ordinarily a persistence of the leucopenia and atypical monocytes.

(c) *Icteric period* — Between the end of the first week and the beginning of the third week of the disease the momentary clinical picture is that of

shows bile tinging, and within 24-28 hours later the patient is obviously jaundiced. This icteric period may vary widely in duration, but averages about ten days, during which time anorexia, nausea and vomiting become outstanding symptoms. The patient is lethargic and there is right upper abdominal discomfort, particularly after any walking or jolting. There is a transient return of low grade fever, the liver remains enlarged and tender and the spleen becomes palpable in about 20% of cases. Skin pruritus is mild or absent and the stools are light-colored for one or two days only – not acholic. During this epoch there is ordinarily a sharp loss of weight disproportionate to the patient's transient inability to take food.

(d) *Convalescent period* – As the icterus fades and a feeling of well-being and return of appetite are evidenced, the convalescent period is in process. All symptoms mentioned follow a diminishing course, the liver decreases in size and tenderness ameliorates. The atypical monocytes disappear from the blood, but the sedimentation rate, which may have remained within normal limits up to this point, rises in about 25% of cases and this increase may persist as evidence of continued activity and suggests further observation and conservative management. Liver function tests, excepting in the presence of continued activity, return to normal and, barring relapses, the sequences mentioned allow a gradual return to normal activity.

*Relapses* – The chief causes of relapses are

- (a) Intercurrent infections, such as pharyngitis, atypical pneumonia, or enterocolitis
- (b) Excess of exercise or alcohol
- (c) Spontaneous relapse

These latter rarely set in while the patient is at bed rest in the hospital, but when they do occur the patient may be more deeply icteric and, in general, is slower to recover than from his original episode.

*Anicteric hepatitis* – Except for icterus, the symptoms and findings of the prodromal, interval, and late periods are encountered as previously outlined. Those particularly suggestive are

- (a) Lassitude, depression and easy fatigability, more marked after moderate exertion
- (b) Discomfort or pain (sometimes quite severe) in right upper quadrant and right lumbar region
- (c) Digestive disturbances, with anorexia, nausea and easy emesis
- (d) Headache and general muscular soreness, particularly upper back (often only day after unusual exertion)

The history, the enlarged and tender liver and the leucopenia, 12 to 30% large atypical mononuclear cells, and sulfalein retention,

increased serum phosphatase and globulin and - in borderline cases - an exercise tolerance test (to precipitate the appearance of one or a number of the foregoing symptoms) indicate the diagnosis of hepatitis without jaundice.

The ratio of hepatitis without jaundice over those with jaundice increases as the epidemic in a unit subsides. Since the cases ordinarily become milder and have a shorter duration, the icterus does not rise sufficiently or persist long enough for notable jaundice to appear. Therapy, rehabilitation and discharge should be followed as for patients with jaundice. The presence or absence of icterus is not a dependable measure of the duration or chronic qualities of infectious hepatitis.

*Infective hepatitis chronic* - Cases showing evidence of chronic hepatitis follow the acute form of the disease either with or without jaundice. The greatest number gives a history of mild jaundice followed by repeated episodes of ration intolerance, while others give histories without jaundice until the third or fourth attack of anorexia, indigestion, weakness, weight loss and debility. Such episodes of apparent continued hepatitis of three to four weeks duration may be scattered over four to eight months.

The chief symptoms are exhaustion or rapid fatigability, indigestion, bloating, flat, C ration or meat intolerance, headaches, depression and discomfort in right upper abdomen or mid-back and sometimes about shoulder girdle on that side.

The chief physical findings are evidence of weight loss, flabbiness, a tender enlarged liver and pain on jarring.

The largest number of instances of chronic hepatitis seem to follow mild cases which were treated on ambulatory or quarters status for irregular or short periods.

Such cases of chronic hepatitis appear on the gastro-intestinal ward, where X rays, gastric analysis and allied studies reveal no pathology. Others are admitted to the psychiatric ward because of hypochondriasis. The recognition and disposition is of considerable importance.

Patients suffering from chronic hepatitis have not been able to remain efficiently on duty status. Unit dispensary care, quarters status, clearing station and hospital admissions characterize this group. It is believed that early recognition, evaluation and disposition of chronic infectious hepatitis should be made to reduce hospitalization and to avoid the natural tendency of others to adopt similar symptoms.

A routine ten-day exercise tolerance test, with careful observation for liver tenderness and increasing size, dye retention, icterus index, sedimentation rate, etc. at intervals, will furnish the answer in 90% of cases.

*Differential diagnosis* - The diseases with which infectious hepatitis

may be confused in its various stages are innumerable. There are a few, in the prodromal period, which merit mention, particularly (1) infectious mononucleosis, (2) atypical pneumonia, and (3) syphilis. The points of differentiation are evident, in spite of certain overlapping characteristics. Heterophile agglutination in the first, the characteristic radiograph in the second (even though auscultatory findings are absent), and in the third a negative Wassermann reaction in the presence of a positive Kahn, plus a rapidly fading titre in the latter, give the interpretation.

Cholangitis, 'acute catarrhal jaundice,' and Weil's disease (leptospirosis jaundice) are sometimes troublesome factors in the icteric phase, while psychoneurosis, various other causes of mid-back ache, and functional gastro-intestinal disturbances call for attention in the anicteric or recurrent (usually without jaundice) form of the disease. Here, a consciousness of the possible presence of one of the latter, plus an exclusion procedure in regard to the former, involving an assiduous palpation for liver edge, and 'jar test' for lower right axillary or lumbar pain and tests for liver function will usually confirm the diagnosis.

*Treatment - Prophylactic* Since the actual mode of spread is not known at present, though transmission by ingestion of infected material has been suggested and produced, strict latrine and mess sanitation are indicated in units where an outbreak of the disease occurs. Furthermore, with the frequency of multiple transfusions in even moderate battle casualties, careful inquiry for features suggestive of recent hepatitis should be instituted in prospective donors to whole blood or plasma 'banks' to rule out this possible factor in transmission, though less than 10% of our series had any history of blood or plasma transfusion.

#### *Active*

- (a) Complete bed rest, and *for sufficient period*
- (b) Fluids forced to 3,500-4,000 c.c. daily (not more than 1,000 c.c. saline by i.v.)
- (c) High carbohydrate and protein, low fat diet (Skimmed milk or milk powder, egg-white, fruit, etc.)
- (d) Vitamin amplification, particularly of vitamin A
- (e) Avoidance of -
  - (1) fatty and fried foods, alcohol (which seems unimportant, however, as etiological agent)
  - (2) too early activity
  - (3) morphia and the barbiturates (or *caution* in their use).

Possible adjuvants -

- (a) Bile salts or desiccated bile
- (b) Transduodenal drainage, and - if cultures positive - a course of sulfadiazine therapy

- (c) Plasma - L.V (6 units over 36 hours)  
(2-6 units per day over a 1½-3 day period)

*Complications* - The only complications necessary of mention are the incidental, ward acquired upper respiratory infection, and gastroenteritis. We were impressed with the apparent frequency of these complications and, on analysis of 500 consecutive cases of hepatitis, found 16+ % having a secondary diagnosis of one or the other, whereas a group of trench foot victims, completely contemporary, identical in size and lying in the same wards, had only a 4% incidence.

Nutritional deficiencies (notably protein and vitamin) have been more evident in this group but whether precursors or resultants therefrom we have not been able to determine.

*Criteria for discharge to duty -*

- (a) Feeling of well being and return of energy
- (b) Tolerance of general diet without gas or indigestion.
- (c) Icterus index normal, no bromsulfalein retention, and *no return of symptoms after ten days of graduated exercise*
- (d) Sedimentation rate normal
- (e) Liver of normal size and non-tender *at end of active day*
- (f) Clinical opinion is still the best gauge for discharge, which will be governed by a balance of the patient's general physical survey the nature of his duties and the exigency of the situation.

### SUMMARY AND CONCLUSIONS

In conclusion, then, we have endeavored to outline the salient features of a disease, infectious hepatitis, which has existed in epidemic proportions about the Mediterranean area, but which has been relatively uncommon elsewhere. From the familiarity with it, bred by experience in that theater we have endeavored to bring certain points to the foreground

- 1 The common clinical picture with the physical and laboratory changes associated with it
- 2 The existence particularly as the epidemic wanes of a form of the disease without a tell tale icterus.
- 3 To urge an awareness of its presence in a so-called chronic active form, frequently without jaundice among the diagnostic problem children on the various services, that they may be properly labelled and relevant treatment applied at a time when an advancing and potentially serious disability may be halted.



## INFECTIVE HEPATITIS IN CANADIAN TROOPS IN ITALY (II)

BRIGADIER J. H. PALMER

*Consulting Physician, Canadian Military H.Q.*

Various attempts have been made to transmit this disease to volunteer, and it seems to have been successfully demonstrated by MacCallums and Havens and Van Rooyen that the ieterogenic agent is present in and can be transmitted by faeces. Evidence pointing in this direction had been obtained in 1942 by a New Zealand Division at Alamain, when two brigades which had had to fight in ground which was heavily contaminated by enemy dead and by faeces had a very high incidence of jaundice as compared with those that fought over 'clean' desert. There is thus strong reason to believe that poor hygiene, flies, and dysentery are important factors in initiating and keeping alive epidemics of hepatitis in the Army.

Some support for the above statement may be derived from Canadian experience in Italy. A survey of the incidence among divisional troops showed it to be almost twice as high in them as in corps troops, which are normally further back from the actual fighting front. Also the incidence in corps troops was almost double that of base troops. In other words, as the hygienic facilities decreased, the number of cases increased.

Of some epidemiological interest is a comparison of the hepatitis incidence in the two Canadian divisions in Italy. The 1st Division landed in Sicily with the invasion forces in July 1943. Its epidemic began late in August and reached a high peak in October, the incidence rapidly falling early in 1944 to a low level. The 5th Armoured Division landed in Italy in November 1943, and was exposed to the epidemic then in progress, in spite of this, until August 1944, its incidence of hepatitis was low. Then it quickly climbed to a peak in September comparable to that of the 1st Division the previous year. At the same time, in the autumn of 1944, a rise in the incidence in 1st Division occurred but its peak was less than half that of 5th Division, or of its own epidemic in the previous autumn. It is tempting to associate the onset of the epidemics with the height of the fly season. The lower peak in 1st Division in 1944 is, of course, due to the immunity resulting from the 1943 epidemic; nevertheless during the intervening year the division was heavily engaged and had received a considerable number of non-immunes as reinforcements.

During the year 1944 a total of 6,379 Canadian soldiers were admitted to hospitals in Italy suffering from infective hepatitis. In general the disease was mild. They were treated with ordinary bed

rest until the urine was free from bile, no other liver function tests were made. Patients were in general allowed to eat whatever they desired from the ordinary ward diets and no attempt was made to make the meals fat-free. The average period of disability for the patients retained in Italy was some fifty days this period included hospital stay and convalescent depot, until the man was fit for full duty. If it was likely that the disability period would be more than three months the patient was evacuated to the United Kingdom. The principal reasons for such disposal were very deep jaundice, relapse within six months of a former attack, and persistent liver enlargement with dyspepsia. In all only 67 patients were evacuated to the U K. in other words some 99% were returned to full duty in Italy. Only 25 of the 67 patients who left Italy were further evacuated to Canada the remainder returned to full duty in the U K.

There were only three deaths in the group under review a mortality of 0.047% this may be compared with a rate of 0.62% (6 deaths) in 976 cases which occurred during the same year in Canadian troops in U K. and North-west Europe.

The incidence of the disease among Canadian officers in Italy is practically identical with that in other ranks this is in contrast to the finding in the British Army where the officer rate is about five times that of the other ranks.

MARCH 1945

## INFECTIVE HEPATITIS ON THE ITALIAN FRONT (III)

BRIGADIER GENERAL HUGH J. MORGAN U.S. ARMY

*Chief Consultant in Medicine*

This disease has presented one of the most stubborn problems with which the Allied medical departments in the Mediterranean theater have had to deal. Owing chiefly to this war great strides have been made in the knowledge of the epidemiology and etiology of this disease, and in the concept of the varied clinical picture. It is well recognized that its course may vary in severity from an illness which is acute, fulminant, and fatal to one which is extremely mild and which may not even exhibit jaundice. Infective hepatitis without jaundice has only recently been established as a bona fide diagnosis. It undoubtedly occurs. How frequently it occurs has yet to be more thoroughly investigated. The incidence of its occurrence certainly varies in different epidemics. It would seem to me to be extremely important to make this diagnosis only after great care has been taken to eliminate all other diseases which may present a similar picture. Many of the

signs and symptoms which have been used as criteria for the diagnosis of infectious hepatitis without jaundice, either of the acute or chronic variety, are very similar to the findings in other diseases which are prevalent in the same areas where hepatitis is occurring. To cite only a few examples – dengue, malaria with incomplete laboratory data, common gastritis, influenza, and even virus pneumonia may simulate mild acute hepatitis. I believe it highly probable that the incidence of acute hepatitis without jaundice would drop sharply if other more common diseases were kept in mind.

The diagnosis of so-called chronic hepatitis without jaundice which has been reported as an occasional aftermath of the acute stage is fraught with difficulties. Many of the symptoms on which the diagnosis of this syndrome is based are very similar to functional disease. There can be no denying that chronic hepatitis does on occasion develop from acute infective hepatitis and there is a likelihood that cirrhosis of the liver can follow an acute attack of infective hepatitis but such a sequence of events must be quite unusual and one should be very careful to take all other possible diagnoses into consideration before a definite decision is made that a patient has developed chronic hepatitis without jaundice.

MAY 1945

## TYPHUS FEVER. CLINICAL FEATURES OF THE NAPLES EPIDEMIC

COLONEL C H STUART-HARRIS

*Epidemiology* – The epidemic began almost simultaneously in all the poorer sections of the city of Naples, and prevailed from early December 1943 to the end of March 1944. About 1,500 cases of typhus fever were notified. The peak was reached in early January and a sharp fall in daily incidence occurred in the middle of this month. Factors underlying the occurrence of the outbreak were numerous but the war brought about refugee conditions among civilians, the use of overcrowded air-raid shelters as temporary homes and the impoverishment of the available food, particularly of first-class protein. Throughout the epidemic, the younger age-groups were involved to a greater extent than the older ones, but the mortality was related in classical fashion to age. Less than 5% of those under 12 and 40% of those over 40 died. The patients, often including entire family groups, arrived at hospital ill-clad, lousy and dirty. Clinical and pathological studies and a therapeutic trial were carried out by the British Army typhus research team whose detailed findings are to be published in a Special Report to the Medical Research Council.

*Clinical findings* - Memory for the early part of the illness was maintained in those admitted during the first week but was often obscured in later cases. The histories which were obtained usually indicated a sudden onset of illness with shivering headache and malaise. Continued chill, high fever, increasingly severe headache and prostration, muscular pains, weakness, anorexia and constipation ensued. The diagnosis was rarely made by practitioners prior to the appearance of a rash on the fifth to seventh day which at once led to admission to hospital. Once the patients were put to bed they made few complaints but vomiting or diarrhoea, cough with mucoid expectoration dysphagia, severe headache and at times mental phenomena necessitated treatment. The typical attack in the young adult was one of continued or remittent fever for fourteen days accompanied by a moderately severe degree of systemic involvement and followed by a complete recovery. In children and infants mild atypical illnesses were common and, in aged subjects, the illness was frequently graver than the average with a more irregular fever and prolonged prostration. During the early stages of the attack, the flushed face, injected conjunctivæ and generalized macular rash on the trunk and limbs attracted attention. As the disease progressed, the rash often became hæmorrhagic, tachycardia increased and blood pressure diminished while added sounds appeared in the chest, the respirations increased in frequency and the facies was increasingly cyanosed. Some form of mental aberration was frequent, though manifestations varied from simple drowsiness, dullness or confusion to agitated delirium or a muttering state which preceded coma. Physical signs of organic change in the nervous system were few but twitchings and tremors of the muscles of the face and forearms with flexor rigidity of the latter were often signs of the gravity of the illness. In general the severity of involvement of the nervous system appeared to parallel the degree of general illness. Also a purpuric rash, oliguria or actual anuria, and evidence of extensive pulmonary or myocardial involvement were bad prognostic omens. Death might occur at any time between the eighth and twenty first day of illness. Complications excluding those of a pulmonary character were uncommon though subcutaneous abscesses parotitis, gangrene of toes or ears and jaundice were all encountered. The prognosis was assisted by blood urea estimations. These indicated the grave import of a urea elevated in excess of 200 mgm. % as pointed out by French workers in North Africa. The cause of the uræmia was obscure and though the urinary output decreased before death the urine was usually qualitatively normal.

*Diagnosis* - The diagnosis was clinically obvious in those with typical attacks but was often impossible on clinical grounds alone in the many cases of mild illness with short fever atypical or absent rash and paucity of physical signs. The absence of any other prevalent

epidemic in Naples at the same time as the typhus led to the presumption that fever unaccompanied by other obvious cause was of rickettsial origin. In previous work in North Africa sporadic cases of louse-borne typhus were found to be hard to distinguish at times from cases of enteric fever. Other differential diagnoses such as influenza, pneumonia, conditions causing coma, malaria or smallpox were more readily distinguished. The pathological findings in cases of typhus in Naples were clear-cut. The leucocyte count was not usually abnormal in the absence of septic complications. There was usually a mild degree of anæmia. The Weil-Felix reaction (OX19) was often positive at a serum dilution of 1:200 by the fifth day and reached maximum titre between the tenth and twenty-first day. The slide agglutination test of Castaneda with coloured OX19 suspension gave good results in early cases and was of great use in epidemiological work. Agglutination of rickettsial suspensions was a useful addition to the Weil-Felix test and indicated that the infection was due to *Rickettsia prowazeki* but did not usually assist in diagnosis at a stage before the W F was positive. Several strains of rickettsiæ of 'epidemic' type were recovered from Naples cases by inoculation of blood intraperitoneally into guinea-pigs. Examination of the sternal bone-marrow for intracellular bodies (Benhamou) was undertaken in a few cases but was not found to be sufficiently valuable for intensive application.

*Treatment* — No specific therapeutic effect was obtained with any of the drugs which were tested, and good nursing, adequate fluid intake and sedatives appeared to be the most important factors in treatment. When fluids could not be swallowed, nasal feeding was employed and intravenous glucose saline was often used as well and appeared to relieve the clinical appearance of dehydration. The benzamidine drugs which were tested and found to be useless in human typhus were more potent in controlling the experimental typhus infection in mice than para-aminobenzoic acid, according to the experience at the National Institute for Medical Research (Andrewes, 1944). The beneficial clinical effect of PABA in cases of typhus in Egypt which has since been claimed by the workers of the Typhus Commission of the U S A (Yeomans, 1944) is therefore in need of confirmation before PABA therapy is adopted. The difficulty in obtaining patients earlier in their illness than the fifth or sixth day and in confirming the diagnosis at this stage, is a serious drawback for therapeutic measures directed specifically against the causal rickettsiæ.

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MAY 1945

## SCRUB TYPHUS

SURGEON LIEUTENANT-COMMANDER CHARLES P HAY, R.N.A.S.

In this short talk it is not my endeavour to try to describe Scrub Typhus as an illness, but rather to tell of the circumstances under which I first saw it at Addu Atoll in the Maldives Island in November 1941.

As far as I am aware, this was the first outbreak of the disease among Allied troops in this war.

At the time I was serving as medical specialist in H.M.S. *Vita* when, in the second week in November we were ordered to proceed to Addu Atoll.

Addu Atoll is a typical coral atoll of the Indian Ocean, enclosing however a magnificent anchorage. On October 8, 1941, over a thousand marines had landed and started to clear sites for camps, guns, roads, jetties, etc. as they were the advance guard of what was ultimately to form a large fleet base. About a fortnight after landing men began to go sick in large numbers with malaria, but in addition to this, exactly ten days after landing the first cases of P.U.O. M. — an undiagnosed condition — occurred and after that every day that passed added two or three new cases. At first these latter cases were thought to be malaria for the initial symptoms were not dissimilar but it soon became evident that this was another disease altogether.

*Vita* arrived on November 21 and the same day I went round the tented hospital with the senior medical officer ashore. The hospital had about 120 cases, 48 P.U.O. M. and the rest malaria.

Leaving the malaria out of consideration, as we went from tent to tent a picture of every stage of the illness was obtained — men newly admitted frightened to open their eyes because of the intense headache or complaining of their back, or in the midst of a rigor. Men who had been in four or five days with an early macular rash on their trunk and limbs, others with an erythematous flush as well as macules, some with no rash but all, as the length of the illness increased, showing a change in faces — a flush with some oedema and conjunctivitis, giving a bloated drunken look, and as further days passed terrible apathy, prostration and wasting, and a continuous temperature of about 103° F.

There, spread out among the few tents, was a picture of every stage of the disease and there was only one answer to the clinical diagnosis — typhus. The Weil-Felix gave the proof, the reactions showing no or very little agglutination with OX19, but agglutination in 1:320 to 1:20,000 with OXK, signifying a wide-spread variety of the disease. The tented hospital was cleared and all patients were taken aboard *Vita*.

The cases were all severe, and a ward full of scrub typhus is a most distressing sight. The temperature continued elevated from twelve to twenty-six days with an average of about sixteen days in most. By that time many of the men were too weak even to swallow fluids and the maintenance of a proper fluid balance proved the most important measure in treatment. Only a little more than half of them showed any rash, though it must be remembered that all were very tanned by the sun and faint rashes may thus have been obscured. In only a small minority could the presence of a local eschar with associated lymphadenitis be found.

Convalescence was painfully slow. Various methods of therapy were tried – the sulphonamides, of course, in one group, with no result whatsoever, except to make the man somewhat more uncomfortable. Convalescent serum was prepared and given in doses of 15 c.c. i.m., and 15 c.c. i.v., but this too showed no effect on the course of the illness.

Many had malaria in addition to their typhus infection and this required appropriate treatment.

Of approximately 100 cases admitted until the end of December 1942 there were no deaths, which I think says much for the nursing they received, for the medical staff can play but a very limited role in this disease.

Investigations undertaken ashore, meanwhile, showed briefly that the rats, which were in profusion and were arborescent in their habits, were infected with *Rickettsia orientalis*, for of those trapped 40% gave a positive Weil-Felix reaction with OKK.

Similarly, the natives gave positive agglutinations both adults and children.

Mites existed in profusion in the scrub and on the fur of rats. Larvæ were found in great numbers on the withered leaves of palm trees and it was obviously impossible to pass through the scrub without coming into intimate contact with them.

Preventive measures had to be improvised at once and the first thing was to recommend that the troops should, as far as possible, pass only along the cleared paths and not go through the scrub. Until mechanical means for clearing could be obtained, the men should wear their light tropical anti-gas suiting whilst at work. Further, that before clearing, the scrub should be sprayed with paraffin oil and burned, and that the camp sites should similarly be sprayed and burned. Rat-proofing galleys and food stores was also advocated.

Whether as a result of these measures or not, the incidence of the disease certainly fell considerably.

This disease, severe as it is, crippling to the efficiency of an army fighting in an endemic area, is obviously of the utmost importance in our present and coming campaigns in the East.

For the fighting man individual protection of some sort is the first requirement.

The use of dibutyl-phthalate as a mite repellent is essential

Furthermore, immunization by *Rickettsia orientalis* grown on the mouse lung method appears to give a good protection and widespread immunization should be undertaken.

In Burma and in the South East Asia and Pacific Commands generally scrub typhus is more or less endemic, and individual protection for our soldiers will be required right up to and including the last battle of all - in Japan itself.





## SECTION III

### Surgical Treatment and Technique

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## ORGANIZATION AND TREATMENT OF BURNS DURING NAVAL ACTIONS

SURGEON COMMANDER J J KEEVIL, D.S.O., R.N.

*Medical Department, Admiralty*

It is important to note that the discussion is on organization and treatment of burns *in action* not *after action*. This involves a paradox, for organization and treatment rest on preconceived ideas and assume fixed conditions, whereas naval actions are unpredictable and their circumstances are never the same. It is my opinion that the fewer preconceived ideas we have under such circumstances the more likely we are to devise effective measures when suddenly confronted with the unexpected. These are situations which cannot be anticipated and may not be measured: they cannot be confined to chart, table, or diagram, and we should not try to conceal our limitations with detailed but inappropriate instructions and regulations.

The terms Naval Medicine, Military Medicine and Aviation Medicine are only justified in so far as they apply to conditions in the front line. When the patients of the fighting services reach hospital they come within the facilities of civil medicine.

It may be that the failure to differentiate between two completely distinct situations is the cause of the great controversy as to the proper treatment of burns.

In a bombed ship and, I imagine, a burning tank, or alongside the wreckage of an aircraft, it is not what is best but what is possible that must be considered.

It is unfortunate that very few of the authorities on the treatment of burns or of the writers to the medical press have actually seen a man on fire, or treated a case except in a hospital bed. Under such circumstances they can indulge in the luxury of leisurely contemplation of their cases and the analysis of records. Their recommendations have much in common with the work of the surrealist painters in that they can only with difficulty be related to the subject of their study. The medium used has varied from the brilliance of picnic through the crusted surfaces of tannin, the kaleidoscope of the aniline dyes to the simplicity of saline from the shining surfaces of paraffin wax to the dusty texture of sulphathiazole. In none of these learned studies have I seen any reference to the need for treating the profound psychological shock which must strike anyone who has first seen his patient while he is still in flames. They all indicate that the patients under consideration had already had their front line treatment, and appear to dismiss this as of slight interest or as having interfered with hospital methods.

It is of little assistance to the medical officer, who first sees the patient to read advice which he is quite unable to follow, while it is a discouragement to him to tell him that, unless he follows it, he is doing more harm than good. It is remarkable how little realism there is in these writings even when they profess to deal with first aid; thus it has been seriously recommended that burn cases in our small fast motor boats should be treated with sterile saline. The writer never paused to consider how the glass bottles of saline would survive the movement of these craft, or how to retain the fluid in bowls, nor can he ever have bandaged what may be the greater part of the body on a moving platform in a cramped position.

To turn to more constructive comments. Such circumstances admit of only one form of treatment and that is an application which can be rapidly smeared on, which requires neither dressing, bandages, nor any professional skill, which will exclude air and relieve pain, which can be supplied in an unbreakable container, is easily portable, and can be widely distributed. Morphina must be given in most cases and above everything all effort on the part of the patient must be absolutely prohibited, stretchers must be very widely distributed and stress laid on their use. It is depressing to read with what complacency doctors have described how their burn cases refused to be carried, but walked to the dressing stations, and how in spite of this fine spirit they died. Admittedly men are difficult to control under such circumstances. I have in mind a young airman caught in a burning aircraft in a hangar on board one of H.M. ships. Having passed through a wall of flame he did a 200-yard sprint that would have done credit to an Olympic runner and, having scaled two ladders, arrived in the sick bay pulseless, incoherent, and in a state of the most intense excitement. The whole of his body was burned except for an area covered by shorts, a vest, and a pair of canvas shoes, the skin was like white tissue paper powdered with soot and already hung in long streamers with serum dripping between them. I believe that in such a case immediate reassurance is of primary importance, for the emotional shock is reflected in the physical collapse. It is appropriate to remember the words of Isaiah. 'Strengthen ye the weak hands and confirm the feeble knees. Say to them that are of a fearful heart, Be strong, fear not.'

Suggestion of a hypnotic intensity is at least as important as morphina, and these two and then a jelly, which can be smeared on in handfuls and will remain on the skin without a dressing, are the measures which will bring the greatest relief in the minimum of time, time which is vital to the patient and important to the doctor, who may be surrounded by such cases.

We all have our favourite methods of treatment, whether they be continuous irrigation through waterproof bags, or the application of a variety of dressings, or immersion in baths. Take the six following circumstances, which are described in the medical officers' own words.

These descriptions are chosen at random and are probably under statements except one written by myself. They may be regarded as typical.

At 3 in the morning a Heinkel III flew over the ship and dropped two bombs, one of which blew up the boilers in the forward boiler room and dense clouds of steam rose for a few minutes until it was shut off. Three men standing on the upper deck were blown into the sea. The aircraft then returned and machine-gunned the ship. All the men in the boiler room had been killed while those in the mess forward of it, whose bulkhead had been blown in, were scalded. All lighting was put out of action, all fresh water supplies were destroyed, many compartments were flooded and all gangways were smashed. Casualties had to be dealt with on the upper deck and, as it was still dark, this was not easy. Five cases were aft on the quarter-deck and the remainder in the fore-castle between was an area where the upper deck had been forced up on each side making an angle of 45 degrees with the sea, and the journey from forward aft was precarious. The ship was in constant danger of sinking and casualties had to be kept with their lifebelts pumped up so that they could float off in an emergency. At 5 a.m. a mist came down and it became cold. We rigged an awning to shelter the wounded from the wind.

Here is a second example -

At 6.30 a.m. the ship was hit by a 250 kgm. bomb which passed through the upper deck. It exploded in the mess decks making a crater the width of the deck and causing an extensive fire. The hands were at cruising stations and the majority of the men were still in, or had just turned out of their hammocks and had little clothing. The fire rapidly filled the crater and made it impossible for the survivors to climb the ladder. All the men rescued complained of being gassed and had acute dyspnoea and fits of coughing. Most of the fatal cases developed pulmonary oedema almost immediately and had copious blood-stained sputum, in some the condition was delayed for six hours. All were extensively burned. The fire on board was difficult to control and continued to spread.

A third example -

On a night of November last year one of H.M. ships was hit by two torpedoes on the starboard side. They penetrated both boiler rooms and brought her to a standstill. Some eight ratings were killed by the explosion, but two others were got out before the water rose and the hatches were closed. Both of these were brought to the sick bay and were found to have second degree burns of the greater part of the body. One was also suffering from pulmonary oedema due to nitrous fumes, and both were profoundly shocked. About 30 minutes later, as the ship was stopped and several submarines were in the vicinity, I decided to abandon the sick bay temporarily and move the wounded to the ward-room higher up in order to avoid adding to the casualties.

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from further expected torpedoes. Shortly after, one or two more torpedoes struck the ship. Until this occurred I had not moved the wounded out to the quarter-deck in view of their shocked condition, but they were now carried out and I attempted to get them to a Carley float, but the ones there had already been cast off. Fifteen minutes later another torpedo struck under the quarter-deck and the ship turned almost on her beam end to port, throwing the wounded and sick-berth staff into the scuppers. After considerable difficulty we contrived to get the wounded on to the guard rails and were working them ast to abandon ship when a final torpedo struck the starboard side of the quarter-deck. Everyone, including the wounded, then got into the water, but in the darkness and general melée the wounded disappeared. The survivors were swept astern, but managed to reach a destroyer, which was stopped half a mile away, having had her stern blown off.

#### A fourth —

This one is from a larger ship which was hit by over 9,000 lb of bombs and which was on fire for over 300 feet of her length, the heavily armoured upper deck was so hot that water played on it from hoses turned to steam. Between decks groups of wounded had collected in ten different places. One of these was the sick bay itself, to which they were taken by their shipmates to await attention. When a medical officer got there he found the following: 'The lights were still burning in the main ward, wounded lay on all the twelve cots and stretchers filled the gangway. The first contained a dead man, the second a marine bleeding slowly to death from a multitude of lacerated wounds, he died very soon after these had been dressed, in the third stretcher was another marine with a compound fracture of the femur and profoundly shocked. Someone had already applied a splint before bringing him there and he was left alone, for alongside the two cots ahead were slowly widening pools of blood which dripped from the wounds of the men lying on them. Then came two burn cases to whom tannafax was rapidly applied. Beyond was a fractured tibia. I was short of tannic jelly so went to one of the two treatment rooms to get some, but found it wrecked and in darkness. Beyond was the operating theatre in complete darkness and with some three or four inches of water swilling about the tiled deck, in the centre of this I found a stretcher. The occupant was still alive and appeared to have a tourniquet round his left thigh, but investigations had to be suspended as the A A gun above the theatre opened fire with a terrific din against aircraft attacking the ship with torpedoes. The darkness, the noise, and the water on the deck, convinced this man that the ship was sinking, and he had to be reassured until the aircraft passed and the firing ceased. A search was then made in the other treatment room, but the door was jammed and, as the passage leading to it was partly under water and had evidently been on fire, this did not offer much

promise. It was possible to get in, however by breaking the upper door panel and inside I dropped into a foot of water and my torch showed nothing but blackness - enamelled bulkheads, metal dressing drums, desk, chair and trolley were all covered in half an inch of soot or under water. The contents of the drums were, however, still usable as were some tins of M & B 693.

In considering this description it must be recalled that this medical officer was working alone, that speed was of great importance, that the situation was only one of many all over the ship and that the future was an unknown quantity.

The next description gives some idea of the bewilderment and uncertainty which is the lot of a medical officer stationed between decks and without any knowledge of what may be seen from the bridge. It also gives some idea of the many demands made on him. In this case 50% of the medical parties had already been killed, and this particular medical officer was stationed in a compartment far below the waterline. He writes -

'Very soon a loud explosion was heard. As we were over a magazine and smoke was beginning to enter the space from the deck above, I ordered the armoured hatch to be closed. Loud speakers then announced that a bomb had fallen through the marines mess-decks and exploded there causing a fire to break out. Tapping was heard on the armoured hatch and we opened it to admit five casualties who included two cases of severe burns these were given morphia and retained below after tannafax had been applied to the burnt areas. One of the telephones in communication with a gun turret then asked for help and then a warrant officer came to tell us that several casualties had collected in the captain's quarters. On arrival there I found about a dozen men some were burned or scalded, some had fractures or lacerations the ward room flat below was full of smoke and steam, but fortunately this did not come up and morphia was given to the casualties and essential treatment carried out. On returning to the dressing station there were further messages reporting wounded but then a loud explosion shook the ship and the armoured hatch was closed as it was thought that bombs were falling. Actually it was a torpedo somewhere amidships. A few minutes later another bigger explosion occurred, which was thought to be a bomb through the quarter-deck. Again in fact it was a torpedo. The ship shook violently and the lights went out momentarily. About one and a half minutes later a still greater explosion occurred and correctly we thought this was a torpedo near us. The ship began to list and we opened the hatch by means of a winch. Water started to pour down into the station and so I ordered the hatch to be opened at full speed and everyone out. Unfortunately it was out of the question to move the two badly burned casualties because it was only just possible to climb the vertical ladder against the fall of water. Two whose duty it was to turn the winch

continued till there was enough space for the men to scramble out. It is estimated that the ship sank within seven minutes'

In the following, which is the last example, some of the difficulties of nursing may be seen

On a very recent date a destroyer opened fire on an enemy cruiser which was firing on the convoy. The destroyer was hit three times shortly afterwards and fires broke out on the mess decks and began to spread. Messages came from various parts of the ship reporting wounded including the captain on the bridge. After attending to him the medical officer writes:—

'On returning to the sick bay it was found to be full of casualties and filled with smoke coming from adjoining messes which were on fire. Fire parties were dragging hoses over the wounded and soaking the patients as they pushed through the smoke to get at the fire. Finding the after-part of the ship was clear and undamaged, the wounded were quickly evacuated there, and equipment salvaged from the sick-bay. A message came asking me to see a casualty who was on the bridge; he had a compound fracture of the left leg just above the ankle and, though he had had a first-aid dressing, was still bleeding slightly. It was impossible to move him at the time as he was jammed behind wreckage and the ship was listing far to starboard and proceeding at 20 knots or more. Although she was still on fire for a further five hours, this was under control and no attempt was therefore made to extricate the man until she arrived in harbour 24 hours later, during which time he was nursed in the position in which he fell and constantly attended by one of the crew.'

There is no need to multiply examples further, but as a contribution to the discussion, I would add that under such circumstances I have found tannafax jelly or an emulsion of tannic and acriflavine very useful.

The official naval burn preparations are:—Triple dye jelly, gentian violet jelly; tannic in pellet, powder, and jelly form; while dried serum is available for the treatment of shock.

With reference to dried serum I know how much value was attached to it as a live-saving measure in the burn cases at Pearl Harbour, but I believe it was given after the men had been landed or had swum ashore through the burning oil, in fact when they came under conditions which are covered by the term 'civil medicine.' The relevant point is, was it given in ships while they were bombed?

In closing I should like to give a quotation which has been sent to me by Surgeon Commander C. Keating, R.N. It runs:—

'From the very great variety of applications so strongly recommended the unbiased individual would be at a loss on what to decide. I presume one of the great causes of error is assigning to various applications the cure of slight burns, some of which would no doubt have got well without any and perhaps much sooner than with those which were

used. If we have seen a person recover from any complaint during the use of any particular means, we naturally imagine such beneficial effect to have arisen from that cause although upon further investigation it may have been found inadequate.

This was written by Edward Kentish in his book published in London in 1797 *Means of Lessening the Effects of Fire upon the Human Body*. It seems possible that we may again be falling into the error against which he warns us.

MARCH 1943

## ORGANIZATION AND TREATMENT OF BURNS EXPERIENCES AT TOBRUK, 1942

LIEUTENANT-COLONEL N J LOGIE, R.A.M.C.

These remarks are founded on experience gained in the treatment of approximately 300 burns of all degrees of severity while serving as a surgical specialist in Tobruk prior to its fall in 1942. The hospital was functioning as a C.C.S.

There was little controversy about the general treatment but there was a great deal about the local treatment especially between the tanners and non-tanners. We, therefore, set out to decide the question in the light of our circumstances, admitting that any conclusions arrived at might only be of local significance and need not apply to other theatres of warfare.

### *Treatment in the field.*

The efficient treatment of a burn of any severity demands anaesthesia. Without it, efficient cleansing is impossible and therefore coagulant agents and dyes should be avoided for they only shut in potential sepsis and render subsequent cleansing more difficult, over and above which they have certain inherent dangers.

The burnt area should be covered and the blisters protected from rupture by an adequate sterile dressing which does not stick, is soothing and is easily removed. For this purpose, a sterile soft paraffin dressing over sulphathiazole powder is best. The general condition may demand morphia and plasma intravenously. Thereafter rapid evacuation for efficient treatment is the object.

### *Conditions in Tobruk.*

Anaesthesia was available but the buildings left much to be desired, nursing was in the hands of hard working keen orderlies who were

continued till there was enough space for the men to scramble out. It is estimated that the ship sank within seven minutes'.

In the following, which is the last example, some of the difficulties of nursing may be seen.

On a very recent date a destroyer opened fire on an enemy cruiser which was firing on the convoy. The destroyer was hit three times shortly afterwards and fires broke out on the mess decks and began to spread. Messages came from various parts of the ship reporting wounded including the captain on the bridge. After attending to him the medical officer writes -

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burns. This prevented early access to the burn, or demanded operative removal of the tan, to allow of early suitable treatment at the base e.g. hydrotherapy and grafting

- (e) 10% silver nitrate tan is a caustic, and if applied to an advanced second degree burn, may precipitate an otherwise avoidable third degree burn and for the same reason it demanded deep anaesthesia.
- (f) In circular lesions of the limbs, there is a danger of a tourniquet effect from the rigid tan and swelling limb

In view of these disadvantages the

3 *Sulphanilamide paraffin and plaster method* was adopted. This method proved to be the one of choice for it fulfilled all our provisos particularly in the case of limbs

- (a) It was easy and relatively quick to apply
- (b) Protection was good against dust, dirt, infection and particularly against trauma.
- (c) Nursing was reduced to a minimum for there were no dressings to replace or readjust.
- (d) The patient and his burn got to the base in such a state that subsequent treatment was not delayed for there was no adherent tan to remove the burns were easily and immediately accessible, the caustic effect of the tan was eliminated the joints were supple and mobile and the young epithelium was healthier
- (e) It was reported from the base that burns so treated were approximately fourteen days ahead of those tan-treated, both in healing and function and they were far more comfortable
- (f) Complete body burns still defeated us though plaster jackets helped. As a rule we had to depend on firm bandaging and, despite their need of readjusting they did better than the tan ones.
- (g) The danger of sulphonamide poisoning was obviated by avoiding sulphonamides by mouth for twenty four hours and forcing fluids.

#### *Technique of local treatment*

If water supply allowed the burn was washed down with soap and water dead epithelium removed gently by stripping with dry swabs, blisters were left intact, the area frosted with sulphonamide, covered with vaseline gauze spreads, liberally overlaid with wool and encased in plaster with a hood for the digits so that free movement was secured

#### CONCLUSIONS

In the field, in the absence of anaesthesia the problem is one of local protection of the burnt area, general resuscitation and early evacua-

few in number but were not nurses. The line of communication was 400-500 miles by an indifferent road, followed by a railway journey, so that ill patients could only go by sea in a hospital ship which only came when there were enough patients to fill her. Dust storms raised a fine dust which penetrated everywhere and everything. Flies abounded and water was scarce. Due to the 'no clothes' fashion, the majority of the burns involved more than one extremity and often, the whole body and face.

### *Ideal dressing.*

The ideal dressing was therefore one which would -

- (a) Be easy and quick to apply, yet efficient. The time factor was of importance for on one occasion we dealt with 30 severe burns in two days apart from other casualties.
- (b) Relieve pain and shock.
- (c) Protect the burn against infection, dust, dirt and trauma both while in hospital and in transit.
- (d) Reduce nursing and dressings to the minimum and make both easy and simple, and, most important,
- (e) Ensure that when the patient and his burn reached the base (possibly seven to fourteen days later) both were in such a state that further treatment, e.g. skin grafting, was not delayed or prejudiced.

Various methods were, therefore, tried

### *Methods*

1. *Dyes* - The dye methods were soon abandoned for dyeing was slow, repeated applications were necessary, protection was poor, infection occurred easily and they required more attention than we could give them.

2. *Tanning* - Of the several methods tried, the silver nitrate tan (10% silver nitrate and 10% tannic acid applied separately) was the best. It had, however, many objections though it suited us.

- (a) It could not be used for the face or complete hand or finger burns. In the former, we feared peri-orbital or peri-oral deformities and, in the latter, it prevented early mobilization.
- (b) In the region of joints, the tan tended to crack and infection followed. This was partially overcome by the use of splints.
- (c) Complete body burns proved an insoluble problem for, though the tan does well when not exposed to pressure and is well ventilated, this was impossible to obtain and the parts exposed to pressure generally broke down and became a sodden infected mass within four to five days.
- (d) Once the tan was applied, it was irremovable until it separated by the normal process of healing in second degree burns or the exudate and sloughing associated with third degree

burns. This prevented early access to the burn, or demanded operative removal of the tan, to allow of early suitable treatment at the base, e.g. hydrotherapy and grafting

- (e) 10% silver nitrate tan is a caustic, and if applied to an advanced second degree burn, may precipitate an otherwise avoidable third degree burn and for the same reason it demanded deep anaesthesia.
- (f) In circular lesions of the limbs, there is a danger of a tourniquet effect from the rigid tan and swelling limb

In view of these disadvantages, the

3 *Sulphanilamide-paraffin and plaster method* was adopted. This method proved to be the one of choice for it fulfilled all our provisos particularly in the case of limbs

- (a) It was easy and relatively quick to apply
- (b) Protection was good against dust, dirt infection and particularly against trauma.
- (c) Nursing was reduced to a minimum for there were no dressings to replace or readjust.
- (d) The patient and his burn got to the base in such a state that subsequent treatment was not delayed for there was no adherent tan to remove, the burns were easily and immediately accessible, the caustic effect of the tan was eliminated the joints were supple and mobile and the young epithelium was healthier
- (e) It was reported from the base that burns so treated were approximately fourteen days ahead of those tan-treated both in healing and function, and they were far more comfortable
- (f) Complete body burns still defeated us though plaster jackets helped. As a rule we had to depend on firm bandaging and, despite their need of readjusting they did better than the tan ones
- (g) The danger of sulphonamide poisoning was obviated by avoiding sulphonamides by mouth for twenty four hours and forcing fluids.

#### *Technique of local treatment*

If water supply allowed the burn was washed down with soap and water, dead epithelium removed gently by stripping with dry swabs, blisters were left intact, the area frosted with sulphonamide, covered with vaseline gauze spreads, liberally overlaid with wool and encased in plaster with a hood for the digits so that free movement was secured

#### CONCLUSIONS

In the field, in the absence of anaesthesia, the problem is one of local protection of the burnt area, general resuscitation and early evacua-



tion In the C C S and field hospital, if they have to be held, the problem is one of continued resuscitation, cleansing, protection, preparation for evacuation to the base where the problem is the restoration of tissue loss, by diet and grafting, early restoration of function and rehabilitation. The best interests of the patient and hospitals are served by the use of a simple, soothing, sterile, proteomollient dressing as suggested above.

In conclusion I should like to say that I was but one of a surgical team who all took part in working out the treatment of these cases. Although the views expressed here may not coincide in every respect with those of my less fortunate colleagues, with whom I have been unable to collaborate in writing this paper, I feel that their names should be associated with it. They were Lieutenant-Colonel A Simpson-Smith, Major E G Collins, Major W Hunter, Major L Rogers, Major R Blackburn (anæsthetist), Captain Johnstone, Captain H J McPherson. They were all taken prisoner when Tobruk fell.

MAY

## THE TREATMENT OF WOUNDS RECEIVED IN AERIAL COMBAT<sup>1</sup>

COLONEL WILLIAM F MACFEE, M C, U S ARMY

*Chief Surgeon, Second Evacuation Hospital*

Observations on the treatment of wounds published during the current war have pertained chiefly to land or sea warfare. The general conclusions reached are that such wounds should be débrided, all dead tissue excised, the surface treated with a light application of a sulfonamide, and after light packing with vaselized gauze the wound should be left open.

After some experience in treating wounded airmen in this manner we were impressed with the infrequency of infection and it occurred to us that these wounds should do well with primary closure. A number of considerations encouraged this point of view —

- 1 The bomber crews whom we are treating live under more sanitary conditions than the ground forces. They are comfortably housed, well nourished, and able to maintain cleanliness of body and clothing.

- 2 The wounding missiles are not grossly contaminated by the soil or other material from the earth's surface. Bits of clothing carried in

<sup>1</sup>Summary of article in *Annals of Surgery*, 1944, 120, p 1. By permission of J Lippincott Company, Philadelphia.

the wounds and secondary missiles derived from the plane are relatively clean.

3 Efficient first-aid is available on the plane at the time of injury and subsequently upon arrival at the air field

4 Wounded airmen usually receive definitive treatment at our hospital within four to six hours after the time of injury

5 A number of surgeons in the first World War practised primary suture under less favorable circumstances with gratifying results. Some obtained healing without infection in more than 90% of the cases treated in this manner

With these facts in mind we began to do primary closures in selected cases. The results were good and the method has been extended to include nearly all cases except those in which extensive loss of tissue make closure impossible. Altogether 257 wounds have been closed by primary suture with primary healing in 244 (95%) of the total. Failure resulted in 9 cases due to infection in 4 additional cases the wounds were believed to be infected and were reopened by the surgeon. Cultures, however were negative.

During the same period four wounds have been closed by delayed suture with successful results in all three wounds have been closed without débridement and all developed infection sixty-eight wounds have been débrided and left open infection developed in sixteen.

In conclusion it may be observed -

1 That primary closure of wounds has obvious advantages when conditions are right for its use.

2 The wounds of aerial combat are received under peculiarly favorable conditions and many of them can be débrided and closed with good prospect of primary healing

3 Primary closure should not be attempted in wounds that are too large to permit closure without tension, in wounds which for some reason cannot be débrided satisfactorily or in wounds where adequate vascularity is in doubt.

JANUARY 1945

## THORACIC SURGERY IN WAR IN THE FIELD AND AT THE BASE

A. TUDOR EDWARDS, F.R.C.S.<sup>1</sup>

*Honorary Consulting Thoracic Surgeon to the British Army*

I am grateful for the opportunity to take part in this discussion and I shall confine my remarks largely to the subject from the base hospital point of view

<sup>1</sup>Mr Tudor Edwards's death since this paper was prepared is widely lamented in the British medical profession and beyond it.

Necessarily the whole subject of 'Treatment of Wounds of the Thorax' is affected by the earlier treatment, and it will be obvious that it is impossible to plan out the correct lines of treatment unless there is close co-ordination between the bases and the forward areas. I am personally convinced that the correct position for chest units should be no further forward than advanced bases, as patients travel less well after operation, except such minor ones as aspiration than before.

Without going into detail, there appear to be seven conditions which require early treatment: (1) the 'sucking-wound' or open pneumothorax; (2) tension pneumothorax; (3) continuing internal hæmorrhage; (4) large hæmothorax causing considerable mediastinal displacement with cardiac and respiratory embarrassment; (5) the severely lacerated chest wall wound with or without penetration; (6) cardiac wound with tamponade, (7) abdomino-thoracic wounds. Some of these can be dealt with in advance of the casualty clearing station, or even of the forward surgical unit; others can be dealt with at the casualty clearing station.

The main definitive treatment of chest wounds should be given at the advanced or main base hospital where patients can be retained after operation for an appreciable period. On arrival at the base hospital, each patient should be entirely reviewed as soon as any necessary resuscitation is completed. This will not only entail an examination of the chest but for other wounds which may have escaped notice. On more than one occasion, a paraplegia has been discovered following injury to the spinal cord from retained foreign body causing the chest wound.

X-ray examination is of supreme importance, exposures being made antero-posteriorly and laterally, and if possible in the erect or semi-erect position to show fluid levels. It is generally essential to get over-exposed as well as normally exposed films to show foreign bodies in lung and pleura.

Men generally reach base hospitals having had the wounds excised if large and lacerated, or maybe on the way to healing when small without other than a sterile dressing having been applied. In a proportion of the former, infection may be established and early breakdown anticipated, but such are much less common since the use of parenteral penicillin, and especially when the skin has not been primarily sutured.

Complete examination may disclose several intrathoracic conditions: (1) hæmothorax with or without air, according to the time since wounding; (2) lobar atelectasis of the same or opposite side; (3) hæmatoma of lung; (4) foreign body, its situation and size, (5) clotted hæmothorax (6) cardiac wound with retention of missile.

*Hæmothorax.* - There can be little doubt with our present experience

that all blood and effusion should be removed from the pleura. It has been definitely demonstrated that the risk of recurrent hæmorrhage from the lung is largely mythical as a result of complete aspiration not earlier than twenty-four hours after wounding. Hæmorrhage ceases as a result of hæmatoma formation in the majority of lung wounds within twenty four hours, unless large vessels are involved when signs of continuing internal hæmorrhage will be evident and necessitate early thoracotomy. When vessels in the chest wall are involved, lung expansion or lung collapse are irrelevant. Therefore aspiration should be carried out early and repeated at twenty four to forty-eight hour intervals until the pleura is dry or infection evident. In a paper on traumatic hæmothorax published two years ago, it was shown that without the aid of penicillin or other chemotherapeutic substances the incidence of infection was diminished by just under 50% if aspiration was carried out within forty-eight hours of wounding compared with those not aspirated or aspirated after that period of time. The presence of such an excellent pabulum for the growth of organisms is an invitation for infection. Again, the incidence of clotted hæmothorax with its necessity for operation to remove the semi-solid contents, and in other instances to decorticate the lung should largely disappear if aspiration is carried out early and repeatedly. Lastly should infection supervene, the residual pocket of infection is likely to be much smaller and healing should be much more rapid.

We have noticed considerable variation in the aspiration of hæmothoraces, and there can be no doubt that when it has been done early and regularly recovery on this side is much expedited. Added to the aspiration, we consider respiratory exercises of vital importance. Particular attention is concentrated on the inspiratory phase which is carried out against firm hand pressure of the physiotherapist, and diaphragmatic movement encouraged by exercises to the abdominal muscles. In our opinion fixation of the chest in the expiratory position with grossly thickened pleura - the fixed chest - will disappear from the sequelæ of chest wounds if aspiration is adequately carried out in association with early respiratory exercises.

The adequate control of hæmothorax is extremely important in restoring a large proportion of the chest wounded back to the fighting line completely fit, within a reasonable period whereas its neglect can result in considerable morbidity and loss of man power not only to the fighting line at the moment but later to industry.

*Removal of foreign bodies* - Anything smaller than 1 cm. sq (approx) is left unless in a particularly dangerous site e.g. lying on the aorta, into which it may eventually ulcerate, or associated with infection when its removal is essential for the closing of a sinus. In these cases in which it is associated with a simple hæmothorax, the latter is treated and the foreign body removed after careful localization about six weeks after wounding. When infection occurs in the hæmothorax the

foreign body, unless easily palpated and removed when the empyema is drained, should be left until a sinus remains leading to its site or until a period of several months has passed after healing, when it is localized and removed if large enough to justify operation. Incidentally, fragments of bone driven into the lung are often more damaging than metallic ones, and should be removed from the lung by thoracotomy after careful localization by X-rays, including screening.

*Clotted hemothorax* - As has been suggested, this may result from delayed aspiration, especially in the presence of a pleural foreign body, or in some cases may be evidence of a mild infection. There is little doubt that its incidence is diminished by early and repeated aspiration. The diagnosis is made by the fact that the shadow of a hemothorax persists with inability to withdraw sufficient fluid to account for the shadow. In some cases, blood-stained fluid is withdrawn from several pockets as a result of repeated punctures. The sooner the pocket is evacuated by open operation, the more rapid the recovery.

It is at such a point that the question of decortication or removal of the fibrin deposit on the lung arises. There can be no doubt that when decortication involves tears into the lung, it should be abandoned promptly, as multiple pulmonary fistulae will result, with difficulty in getting rapid pulmonary re-expansion established. In many cases where decortication is easily performed without pulmonary laceration, the lung cannot be expanded by any reasonable intratracheal positive pressure, and this is probably due to hemorrhage into the lung or early fibrosis secondary to it. Since the use of intrapleural penicillin it has been found possible to decorticate the lung successfully in many cases of infection with a sensitive organism. Such cases should have a small airtight intercostal tube inserted at the end of the operation for subsequent aspiration and the instillation of penicillin.

*Hematoma of lung* occasionally appears as circumscribed rounded or oval shadows in the lung by X-ray. They may include the metallic foreign body, and most of these absorb rapidly with little or minimal symptoms. Occasionally infection occurs, and the patient may suddenly begin to expectorate blood-stained pus, and at this stage the X-ray may show a shadow with a fluid level. Such abscesses should not be operated upon without a full and adequate trial of postural drainage, which clears up the majority of them, even when a small body is present.

*Empyema* - A striking feature of the figures is the low incidence of pleural infection - empyema. Throughout the group the incidence was 8.7%. During the last war, the incidence of infection was given by Bradford and Elliott in 170 cases as 37%. Likewise, in 126 cases which I recorded in 1943 as secondary to penetrating bomb wounds incurred in this country, the infection rate was 21.9%, although in those aspirated within forty-eight hours of wounding, the infection rate was lowered to 12.5%. The only factor which appears to be responsible

for the further lowering of the infection rate seems to be the use of penicillin, which should be employed as an intrapleural installation. In my opinion the incidence of infection can still be materially reduced by more attention to the foregoing details.

### STATISTICS OF CHEST CASUALTIES

*Total number of chest casualties admitted into the chest centres in this country between D-day and September 30 1944 1 683*

*Treatment. -*

- (i) The great majority were treated by *aspiration for hemothorax*.
- (ii) Other treatments were
 

(a) Removal of foreign body	246 (15 %)
(b) Turning out clot	103 (6%)
(c) Decortication	94 (5.5 %)
(d) Empyema	148 (8.7 %)

Deaths numbered 9 (0.5 %)

*Earlier Group - at advanced centres at Cosham, Southampton and Withhurst.*  
Out of total of 251 casualties, treatments were

- |                             |            |
|-----------------------------|------------|
| (a) Removal of foreign body | 35 (13.9%) |
| (b) Turning out clot        | 26 (10.3%) |
| (c) Decortication           | 21 (8.4%)  |
| (d) Empyema                 | 39 (15.4%) |

Deaths 5 (2 %)

### ANALYSIS OF DEATHS FOLLOWING CHEST CASUALTIES.

<i>Total number</i> out of 1 683 casualties	9 (0.5%)
In earlier cases, out of 251	5 (2%)
In later cases, out of 1,432	4 (0.28 %)

*Causes in the five earlier cases -*

- (1) Thoraco-abdominal wound, splenectomy shock and haemorrhage.
- (2) Incompatible blood transfusion.
- (3) Perforated oesophagus.
- (4) Bronchopneumonia and anoxia following rupture of empyema into bronchus shortly after admission.
- (5) Toxaemia

*In the four later cases -*

- (1) Results of abdominal wound.
- (2) Bronchopneumonia.
- (3 & 4) Other wounds.

## THORACIC SURGERY IN WAR IN THE FIELD

LIEUTENANT-COLONEL CHARLES STUART WELCH, M C, U S ARMY

*Chief Surgeon, 91st Evacuation Hospital*

During the first six months of the campaign in Northern Europe, 380 men with thoracic injuries involving pneumothorax and hemothorax were admitted to an American evacuation hospital. This number was 4% of all battle casualties received during the same period and probably represented a cross section of patients with intrathoracic injuries in the combat zone. The majority were American battle casualties but included in the group are Allied wounded soldiers, prisoners of war, and civilians.

Of the wounds 69% were caused by shell, mine, or grenade fragments, 26% by bullets, and 5% by blunt trauma. Penetrating wounds were two and a half times more frequent than perforating wounds. The right side of the body was involved in 50%, the left in 45% and in 5% wounds were bilateral.

### PREOPERATIVE MANAGEMENT

The important objectives in preoperative care are - (1) the treatment of shock, (2) the temporary closure of sucking wounds, (3) the alleviation of pain and anoxia, (4) the care of complications such as tension pneumothorax and massive hemothorax by aspiration or intubation, (5) the recognition by physical and roentgenological examination of the extent of thoracic injury and the detection of associated injury of the abdomen or other parts of the body. Shock of moderate to severe degree was present in 37%. In 29% an open pneumothorax was present when the patient was admitted or was evident after retraction of the soft tissues of the thoracic wall at operation. Two patients had bilateral sucking wounds and four had two sucking wounds of the same side. Additional injuries unrelated to the thoracic wound were present in 46%. Many of these were severe and major surgical problems.

The time interval between wounding and admission varied, depending upon the tactical situation, and averaged eight to twelve hours. An almost equal length of time was consumed in preoperative care for the severely wounded after admission to the hospital. Most patients improved after rest, transfusions of blood, oxygen therapy, and aspiration of the pleural cavity, and, except in those with uncontrolled bleeding, time and care in supportive treatment was well spent.

### NON-OPERATED CASES (Table, see p 135)

Eighty-eight patients were not operated upon. Twenty-eight of

these died without operation. These were severely injured men, frequently with multiple wounds who could not be brought to the operating table profitably and who died soon after admission.

Sixty patients were evacuated to the base area hospitals without being operated upon. These patients, for the most part, were those with hemothorax from small shell fragment wounds and perforating bullet wounds whose condition was good. Chest aspiration was performed in many and they were frequently kept seventy two hours before evacuation.

### OPERATED CASES (Table, see p 135)

Two hundred and ninety two patients were operated upon. These are divided into 222 with thoracic injury and seventy with combined injury of the thorax and abdomen (thoraco-abdominal injury)

#### I - Thoracic injuries

(a) In the group of 222 patients with thoracic injuries, 123 required only minor operative procedures such as wound débridement with aspiration of the pleural cavity or closed intercostal drainage of the pleural cavity for forty-eight hours.

(b) Sixty-two patients required *thoracotomy* a term reserved for those operations in which the thorax was widely opened for inspection and intrathoracic operative procedures. The principal indications for thoracotomy were (1) Large sucking wounds with rib fracture, (2) large hemothorax from continuing intrathoracic bleeding (3) penetration of the diaphragm, (4) suspected wounds of the heart or mediastinal structures, and (5) large intrapleural foreign bodies (over 1.5 cm. in two diameters). Thoracotomy incisions were usually made at the wound site after its excision and in 89% of the cases a fractured rib was excised. Among the intrathoracic operations performed were suture of the lung (25 cases) removal of intrathoracic foreign bodies (13 cases) and removal of shell fragments from the heart (2 cases). Closed catheter intercostal drainage of the pleural cavity for forty eight hours was usually employed after thoracotomy since it more effectively dries up the pleural cavity than repeated aspirations.

(c) In the case of 37 patients operations short of thoracotomy were performed. Commonly exploratory incisions were made, fractured rib segments removed, and open pleural defects closed. In approximately one half of this group closed, catheter intercostal drainage of the pleural cavity was used for forty-eight hours.

#### II - Combined injuries of the thorax and abdomen (thoraco-abdominal injuries)

There were 70 patients operated upon in whom injury of both the thoracic and abdominal cavities existed. Five operative procedures were utilized.



(a) Thoracotomy and transdiaphragmatic operation was employed for those patients requiring thoracotomy and having involvement of the upper abdominal structures (diaphragm, liver, stomach, spleen) These organs are the most frequently injured and fortunately easily operated upon through the thorax

(b) Thoracotomy with celiotomy, or separate approach to both cavities, was required for the repair of intestinal perforations and extensive liver injuries, inaccessible through the diaphragm at thoracotomy

(c) Celiotomy alone was used when the thoracic injury was minimal and the abdominal operation was indicated Small wounds of the diaphragm were repaired at celiotomy Aspiration of the hemothorax was frequently necessary in this group

(d) Kidney explorations were performed for thoraco-retroperitoneal types of injuries in which the major problem was the damage of the kidney

(e) Minor operative procedures were all that were required for small shell fragment wounds of the right thorax involving the liver Aspiration of the hemothorax with wound débridement was all that was necessary in this group

#### SUMMARY

Sulfadiazine and penicillin therapy was employed in all patients in whom no contra-indication existed Patients with major thoracic operations were kept in the evacuation hospital for seven days before being sent to base hospitals in the rear Those with abdominal injuries were hospitalized for a minimum of ten days before evacuation Operative procedures required for other injuries were usually done on completion of the thoracic operation but were delayed twenty-four to forty-eight hours in severely shocked individuals

The general mortality rate among the 380 patients was 16% It must be borne in mind that serious injuries in addition to those of the thorax contributed to death and in some patients were the principal cause of death

The operability rate was 91% for the 320 patients (Sixty did not require operation)

The general operative mortality rate was 11% The operation of thoracotomy for thoracic injuries had an 18% mortality rate Thoracotomy with transdiaphragmatic operation alone or in combination with celiotomy for patients with thoraco-abdominal injuries had a mortality rate of 24%

# DATA IN 380 CASES WITH CHEST INJURY ASSOCIATED WITH HEMOTHORAX AND PNEUMOTHORAX

	<i>Number of cases</i>	<i>Per cent of total</i>	<i>Number lived</i>	<i>Number died</i>	<i>Per cent died</i>
<b>NON OPERATED CASES</b>					
I. Thoracic injury	75	19.8	57	18	
II. Combined thoracic and abdominal injury	13	3.4	3	10	
<b>OPERATED CASES:</b>					
I. Thoracic injury: totals	222	58.4	202	20	9
(a) Minor procedures	123		114	9	7
(b) Thoracotomy	62		51	11	18
(c) Other major pro- cedures	37		37	0	0
II. Combined thoracic and abdominal in- jury: totals	70	18.4	58	12	17
(a) Thoracotomy and trans diaphragmatic operation	30		23	7	23
(b) Thoracotomy with celiotomy	12		9	3	25
(c) Celiotomy alone	18		16	2	11
(d) Exploration of the kidney	3		3	0	0
(e) Miscellaneous minor procedures	7		7	0	0
Totals	380	100	320	60	16

JANUARY 1945

## THORACIC SURGERY IN WAR AT THE BASE

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### THE EARLY ASPECTS OF CHEST INJURIES

*Introductory* - In warfare the most common form of thoracic injury is the penetrating wound caused by high explosive fragments or bullets, but extensive damage can be produced by crush or blast injury without any external wound. In both cases the patient's condition must be viewed on two counts - the first being the degree of shock, hæmorrhage and general disturbance and the second the effect on the chest itself and its contents. A further complication that obscures accurate assessment is that wounds are often multiple and do not allow the chest to

be taken as a simple unit for analysis. However, it is important to try to decide how much the physiology of the chest has been disturbed and what are the possibilities of rectifying it. The clinical picture of shock may be exaggerated by the presence of a sucking chest wound or a tension pneumo- or hæmo-thorax and the immediate restoration of normal chest physiology should take priority over resuscitation measures. To wait until the effects of shock and hæmorrhage have been fully countered may be to wait in vain. I recall the case of a pulseless soldier with an abdomino-thoracic injury producing a wide open pneumothorax: he appeared practically dead, but operation which included arrest of hæmorrhage, splenectomy and much visceral repair was completed with the pulse rate at 100 and blood-pressure over 110.

*General treatment.* - Generally speaking the average chest case reaches medical attention in a serious, shocked and distressed condition. Pallor, distress and coldness (particularly this last) are well marked and the standard resuscitation measures should have full play. There are, however, several small points which require emphasis. There is still an occasional belief that morphia should not be given to the chest case lest it should depress respiration and the cough reflex. This does not hold, and full, though not excessive, doses produce the necessary sedative effect which makes for increased comfort, quieter respiration, and with diminution of pain allows much more effective cough effort. Blood and plasma are sometimes withheld owing to fear of embarrassing the circulation, but this does not seem justified so long as the normal indications for transfusion are not exceeded. The value of high concentration oxygen is accepted, but it has been somewhat depressing to see how often it is wrongly used. Too low a rate of flow, badly fitting face or nose-piece, and intermittent use all vitiate against effective use. Oxygen should be an asset and not an irritant to the restless patient.

*Interference with chest function.* - The actual interferences with chest physiology which may have to be considered can fall under two headings: -

(1) The closed chest, in which a raised intrapleural tension is maintained by blood or air.

(2) The *open* chest, which includes many 'sucking' wounds and in which the phenomena of mediastinal flutter and paradoxical lung movement contribute to respiratory and circulatory distress. Tension pneumo- or hæmo-thorax requires special emphasis on account of the frequency with which it is overlooked. A tear in lung surface with repeated coughing or slow steady intrathoracic bleeding may lead to the pleural tension developing beyond the stage of lung collapse with pressure on the mediastinum and opposite lung. If it is recognized or even suspected an aspirating needle will demonstrate whether blood or air is present under pressure. Many small sucking wounds which have become closed by nature or art can become dangerous if the

possibility of excessive air and blood accumulation is not realized and guarded against.

*Early surgical treatment* - The problem of the methods of handling 'sucking' wounds is a somewhat complicated one. It depends so much on what and who is available but the essential is to aim at a functionally closed pleura. Where there is adequate equipment and a surgeon who knows his way about the inside of the chest revision of the wound repair of internal damage and closure would be the ideal, but up-the-line conditions do not allow this and an air tight closure must be achieved by grease dressings oiled silk and strapping until more definitive surgery can be obtained. Between these extremes varied procedures can be adopted but certain definite indications must be observed. Large lacerated wounds into the pleura require careful revision with removal of retracted muscle and broken bone. Dirty in-driven rib fragments are dangerous sources of later infection. Further advance into the depths of the chest must be determined by the confidence of the surgeon.

A small intercostal extension of the original wound may allow full intrathoracic inspection and removal of a retained missile, but unless the surgeon is experienced in this branch of surgery, he probably serves the needs of the patient best by attending to the immediate problem and leaving deeply placed foreign bodies and other complications for later handling. However, the possibility of any transdiaphragmatic injury is a definite indication for making a deliberate intrathoracic operation so that the diaphragm can be viewed. Any penetration of this vascular sheet necessitates extension of the opening so that the upper abdomen can be inspected.

*Closure of the chest.* - Completion of the operation may be complicated by the problem of closure of any gross deficiency in the chest wall but first the chest should be sucked as dry as possible. Pleura cannot be sutured and whereas clean intercostal muscle helps it is on superficial muscle that the closure of the chest depends. Sliding muscle flaps designed with an eye to the nerve and blood supply may have to be used if the muscle layers after excision cannot be approximated without tension. Considerable ingenuity may have to be exercised and visualization of the latissimus dorsi, pectoral and serratus magnus sheets should be borne in mind. Final skin closure should not be too tight, particularly if there is any doubt about the efficiency of excision of dirty muscle edges it is safer for any infection to discharge externally and not to burst into the pleura where the consequences might be disastrous. At the end of the operation as much air as possible should be sucked out. Penicillin in powder form to the raw edge and some liquid penicillin into the pleura is a useful prophylactic.

The final question to be considered is that of pleural drainage. Some reactionary exudate is inevitable and the chances of infection will exist until the lung has fully expanded and obliterated the pleural

dead-space Repeated aspiration for removal of fluid and its bacteriological examination is the most satisfactory form of after-treatment, but it needs most careful control and observation – factors that may not obtain during transit from one place to another A closed water-seal drain makes the pleural position safe and avoids the risk of tension developing, but even this provision has disadvantages Leakage or incorrect handling of the apparatus has its own dangers The long and the short of it is to ensure that correct after-treatment is carried out and provided for even when the patient passes out of the hands of the original surgeon

*Hæmothorax* – Bleeding into the pleural cavity is the principal complication of all chest wounds Sometimes the severity of the original hæmorrhage constitutes an urgent indication for surgery, intercostal arteries and the internal mammary artery are frequent sources of free bleeding More massive loss of blood from great vessels does not allow many survivors. It is, however, remarkable how often bleeding from even three or four torn intercostals becomes arrested Bleeding from liver substance may be very persistent but bleeding from peripheral lung tissue is rarely significant since the tense interstitial hæmatoma that forms helps to control the oozing The size of a hæmothorax is often surprising, and 3, 4 and even 5 pints is not uncommon

The treatment of all hæmothoraces depends on certain simple principles, which however are rarely adhered to with any accuracy Briefly put, the aim is to remove the fluid blood as early and completely as possible The initial aspirations should be started within forty-eight hours of injury and continued daily or on every other day until the chest is completely dry and the lung fully expanded Failure to continue with aspirations or their erratic performance owing to rush of work or transport problems has resulted in most hæmothoraces persisting long after the fourteen days that should be enough for their adequate control Deliberate air replacement cannot be countenanced as an aid to aspiration since it allows the apex of the lung to fall downwards and leaves a potential total empyema should infection supervene Another frequent deterrent to complete and early aspiration is the fear that bleeding may be started again – a fear that has been proved groundless Clot formation and fibro-thorax are with infection a later complication which in a proportion of cases could have been avoided by following strictly the main principles

*Chest exercises* – Finally a word to be said in support of the valuable inspiratory chest exercises which have had their origin in this country Their role in restoration of chest function is incalculable and they can be inaugurated within a day or two of injury Their continuance during all phases of recovery helps to gain the excellent functional results that have followed in the great proportion of chest injuries during this war

TRENCH FOOT<sup>1</sup>

MAJOR LEIV KREYBERG NORWEGIAN ARMY

In the description of trench foot and similar conditions, terms and designations are used which are not sufficiently well defined to form a solid base for discussion and conclusions. My first point is a plea for definitions and standardization of terms of description.

Take for instance the term *hyperæmia*. A distinguished writer on the present subject writes 'The hyperæmic stage, which follows the initial cold stage begins abruptly. Hyperæmia and cold are not good contrasts, as the cold stage may be hyperæmic.'

I think it would be a great advantage if the condition of the skin was described by colour and by temperature the two characters which give a rather complete picture of the circulatory state of the skin.

The depth of the colour usually gauges the size of the minute vessels. The tint of colour is more complex, partly being an indicator of the rate of the blood flow but is also related to the consumption of oxygen in the tissue locally. Temperature within certain limitations expresses relative rate of blood flow (Lewis).

The colour may range from leaden blue, through deep blue to plum colour purple, deep red bright red to pink, with grades of depth of colour.

Venous congestion of the skin is one of the types of hyperæmia, and also reactive, inflammatory and others.

The other term I should like to mention is *stasis*. In medical literature to-day the word 'stasis' has several widely different meanings. In clinical literature, and even in most textbooks of pathology stasis means venous congestion. Sometimes the word is used in its literal sense as meaning arrest of the blood flow. Finally it is used in its specific meaning which was defined in the middle of the last century.

The specific meaning of stasis is as follows. Under a series of different influences the permeability of the blood vessels may be greatly increased. If the permeability reaches a very high degree a complete escape of the blood plasma into the surrounding tissue takes place, leaving the blood cells packed and dry in the lumen of the vessel, forming a transparent column to the *in vivo* inspection. The process may take place in a couple of seconds, in the course of minutes, hours or days, according to circumstances. A fully-developed stasis is usually an irreversible process, leading to the ischemic death of the tissue served by the vessel as well as the vessel and its content itself.

<sup>1</sup> A more comprehensive discussion of the problem is undertaken in a paper in the *Lancet* (1946) (i) 538.

The development of stasis is often accompanied by diapedesis

A survey of the external and individual conditions favouring the development of trench-foot shows that the injury to the tissues is twofold – a disturbed metabolism, caused by the cold itself and a reduced blood flow (and probably also a reduced dissociation of hæmoglobin) One of the first elements to suffer from the local tissue damage is the endothelium of the minute vessels Accordingly one of the first symptoms to be observed is œdema, an expression of *increased permeability*

During the cold stage (anæmic or hyperæmic) the tissue metabolism is greatly reduced also the processes leading to degeneration and necrosis

When the victim is brought under treatment in a room with a higher temperature, the first clinical reaction from the foot is a re-establishment of the arterial blood flow, even if this reaction may be delayed The skin turns brilliant red or deep red, and the temperature is raised The reaction is probably twofold A *reactive hyperæmia* in its specific sense, and an *inflammatory hyperæmia*, caused by the tissue damage.

It is a fulminant vascular reaction which precedes the tissue necrosis, and the death of the tissue is probably not caused by an impaired circulation due to pressure of œdema or thrombosis, but rather through the development of *true stasis*

Stasis as cause of necrosis has been well known for nearly a hundred years, but the frequency of this mechanism has not been generally realized because of the diagnostic difficulties

FEBRUARY 1945

## TRENCH - FOOT

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In every war trench-foot has been a serious cause of casualties In the last great war there were 84,670 such casualties in the British Army. In the week ending December 16, 1916, there were 3,104 cases in France and Flanders alone One blizzard in November 1915 caused 15,900 cases in Gallipoli and 988 in Serbia After 1916 the incidence fell rapidly. It was realized that trench-foot is almost completely preventable.

Given proper training and equipment, the incidence of trench-foot is an index of discipline. It is the Army in retreat, low in morale and with communications in disorder, that suffers most severely. In other circumstances, it is almost as foolish to get trench-foot as to blow off one's big toe with a rifle. There are bound to be unexpected circum-

stances in war to make the occasional case unavoidable, but once an epidemic has been controlled every case should be the subject of inquiry. Almost every such inquiry will bring to light an error in training, equipment, or discipline which, checked in time, will save not merely sections or platoons but even brigades and divisions.

A way of life in cold damp weather must be learned by medical officers, combatant officers and every individual man. The maintenance of cold weather discipline must be the responsibility of combatant officers, but it is the duty of the medical officer to see that his brother officers understand the reasons for the rules, and are continuously alert for breaches of them. In the battle against cold there is no place for toughness. The man who breaks the rules and gets away with it is not a hero but a lucky fool. Moreover, he is a stumbling-block to those less well adapted, and he should be treated as a criminal.

*Preliminary training* - In the training of troops it should be remembered that the physiological reactions to cold, which are the concern of the adrenal medulla, the thyroid and the autonomic nervous system, are themselves capable of being trained. In those habitually overclad they become dulled. Troops should accustom themselves to exercise for short periods in minimal clothing in the coldest weather. In safe surroundings no more should ever be worn than is necessary to prevent shivering.

*Clothing* - Clothing must be as nearly as possible waterproof, for the great thermal conductivity of water is to blame for trench foot. It should also be windproof, so that the protective warm layer of air about the body is not too often blown away. Clothing should be in many light layers rather than a few heavy ones, for the air caught in the interstices is of more value than much wool.

All clothing must be loose, for the essential cause of tissue damage in trench foot is exudation from damaged capillaries, and the slightest venous constriction raises the intra-capillary pressure to a serious degree. For this reason puttees were discarded. Boots must be loose, supple, well oiled, and preferably without toecaps. Socks should be undarned and loose. Most men can realize that tight boots are dangerous, they forget that tight socks are equally so. They forget too that though it is good to wear two pairs of socks if the boots are large enough, it is dangerous if they are not. Ideally, the outer socks should be a size larger than the inner, but this is usually impracticable. Garters and sock suspenders should be forbidden, the socks being kept up by pinning to the pants. Gloves also must be loose. Some people favour an inner glove of thin silk covered by a woollen one, with a big outer waterproof glove. I have always found an ordinary woollen glove perfectly satisfactory and the silk one unnecessary. The outer waterproof glove is important. It should be without separate fingers and loose enough to slip off easily when fine finger movements are needed.



• *Damp* – Dry extreme cold is far less to be feared than damp slight cold. Trench-foot has occurred in temperate climates even in spring. For this reason it is absolutely necessary that wet clothes, especially boots, socks, and gloves, should be changed at every opportunity. Combatant officers sometimes regard such an instruction as 'soft', they must be overruled. A general routine order to British Armies in France in November 1915 laid down that every man should carry a second pair of socks, and that where possible battalion arrangements should be made for socks to be dried and reissued during each tour of duty in the trenches, and that while in the trenches boots and socks should be taken off from time to time if circumstances permitted, the feet dried, well rubbed, and covered with dry socks. Although much more is now known of the pathology of trench-foot, it is almost impossible to improve on this order and the later Fourth Army standing order of June 1917. Obviously the one extra pair should be increased to several whenever possible. Even if the boots cannot be dried, dry socks are a considerable protection.

The provision of gum-boots for use in waterlogged trenches is important, but sweat is dangerous, and gum-boots are sweaty things. Men must not march far in them. In the last war it was usually possible to arrange for men going forward for a tour of duty in water-logged trenches to call at a post where they removed their boots, performed foot drill, and put on dry socks and gum-boots. On their return they left their wet socks and gum-boots, again performed foot drill, and donned dry socks and boots before going down the line.

Foot drill was performed in pairs. Each man washed the feet of his opposite number in warm water and carefully dried them. He then, in the early part of the war, rubbed in whale oil, but it was later found that oil was unnecessary and a powder of talc and camphor was substituted. The benefit of the whale-oil treatment probably rested in the rubbing. All abrasions were reported to the medical officer. A double washing with ordinary and special soap was ordered, but this is probably unnecessary. A single wash with ordinary soap is probably as good. Foot drill should be performed in cold weather, both in and out of the trenches. A good method of drying boots is to lay 6 feet of gas-pipe across a brazier, push one end into the toe of a boot, and blow air from the other end with a bellows. If the business end of the pipe is made like a toasting-fork many pairs can be dried at once. These measures were often regarded as fussy, but the proof of the pudding was in the eating. The incidence of trench-foot fell dramatically after the winter of 1915-16.

*Stagnation* – After constriction the most important cause of increased intracapillary pressure and consequent œdema and tissue damage is venous stagnation. Men must be taught not to stand still, slumped into their boots, but to keep the muscles of their calves continuously

in motion. They must lie whenever possible, with their feet higher than their heads - a manoeuvre which lowers venous pressure. They must not sit on seats, boxes or firesteps in such a way that the popliteal space is constricted. They must on no account bring their feet near a fire if they are cold or numb but warm them between a companion's hands or inside his clothes. Boots must be unlaced or better, removed at every opportunity and at least twice a day.

*Food* - The warming power even of cold food is considerable, and men in danger of trench-foot must be kept well supplied. Hot food is of course, far better. Arrangements must be made by means of heat insulated containers, self heating tins, or such devices as Tommy's cookers for a regular supply of hot food and drink to men in exposed situations.

*Trenches* - The design of trenches in mobile warfare is easy to neglect, but is neglected at peril in a thaw. Whenever possible they must be properly drained or as a second best, provided with duck boards. Men cannot stand long periods in damp trenches. Commanding officers may be aware of this in theory but they may suffer from a wishful faith in the capacity of their own men to rough it out. Such faith is always misplaced. Human physiology is remarkably but not infinitely adaptable. No equipment, however good no precautions, however studious, and no watchfulness, however devoted will avail if men have to spend more than twenty four or at the most thirty-six hours in a waterlogged trench or fox hole. If the prosecution of the war demands that men should fight in such conditions, the High Command must allow for high casualties. It is unreasonable that allowance should be made for casualties from firearms and not from the equally predictable hazard of cold.

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FEBRUARY 1945

## TRENCH FOOT

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In the Medical History of the War 1914-18 Vol II page 200 it is stated 'It has been established beyond dispute that trench-foot can be prevented. This is borne out by the fall in the incidence rate, among British and Dominion troops in France and Flanders, from 38.45 per 1,000 per annum in 1915 to 11.34 in 1917 and finally to 3.82 in 1918. The incidence rate among men of the 21st Army Group during the winter months of 1944-45 was very low.

The Regulations which produced this striking fall are contained in  
 (a) General Routine Orders issued to British Armies in France, Part I, Adjutant-General's Branch G R O 1275, dated November 28, 1915

(b) Fourth Army Standing Orders, Part I, Adjutant-General and Quartermaster-General's Branch, dated June 20, 1917

These contain the 'magic' that practically eliminated trench-foot from the British Armies Mineral jelly, anti-frostbite grease (whale oil, tallow, and boric acid) and whale oil alone were given up in favour of foot powder The measures advocated in 1917 are substantially the same as those contained in G R O 729 (21st Army Group) dated December 20, 1944, upon which are based my further remarks

Trench-foot is caused by prolonged standing in cold water or wet mud (especially after a long, rapid march when the feet have become hot and swollen), or by the continued wearing of wet socks and boots The temperature need not be below freezing point, indeed the condition occurs more frequently when frost alternates with thaw and rain

Unclean feet, fatigue, want of exercise, and constriction at any point of the leg add to the risk

The symptoms are pain, the foot is cold, numb, swollen and red, there may be blisters

#### PREVENTION OF TRENCH-FOOT

First essential is provision of the necessary material, secondly, instruction in its use *before* the need arises, thirdly, discipline, to ensure its use Discipline is the regimental officer's responsibility, not the medical

*Material* - Two pairs of good stout boots, large enough to allow for shrinkage and to take two pairs of socks Boots must be well dubbined

Means must be provided for drying boots Boots, rubber, thigh, supplied for 5% of troops entering a waterlogged area, boots, rubber, knee, for 30% Beware of constriction due to socks slipping or from any other cause Men must not march long distances in gum-boots nor wear them for longer than thirty-six hours as a maximum, as the feet become wet from perspiration

*Socks* must be woollen and thick Present scale of issue, three pairs per man, with a fourth pair available on certificate of A D M S The importance of dry socks stands very high, eight pairs per man would not be too many

#### INSTRUCTION AND DISCIPLINE

*Action before entering a waterlogged area*

(a) Wash the feet, first with ordinary soap and hot water, then with special foot soap

(b) Dry carefully



FIG. 1 - Severe non-penetrating head wound, (a) Before operation, (b) After operation showing complete closure of the wound



- (e) Powder the feet and rub well in, also between the toes.
- (d) Powder a clean pair of dry socks and put them on at once.
- (e) Men will carry two extra pairs of socks.
- (f) Do not lace boots tightly
- (g) Chiropodist.

*Action in meteorological areas.*

- (a) Drill, as above, twice daily. If no hot water is available for washing, dry the feet and then powder.
- (b) Gum-boots to be worn as directed.
- (c) When feet are numb, they are not to be placed in hot water or near a fire.
- (d) Drying facilities must be provided for boots and socks.
- (e) Men must be relieved frequently if possible.
- (f) Men should move about when not standing-to.

The danger of tetanus developing with trench-foot should be borne in mind.

*Standard formulae*

(1) <i>Foot powder</i> -		Parts by weight
Talc powder		100
Camphor (or technical camphor)		10
Boric acid		15
Scale of issue = 1 oz. per man per week.		
(2) <i>Foot Soap</i> -		
Soft potash soap		1,000
Powdered camphor		25
"    sodium borate (when available)		100
Scale of issue = 2 oz. per man per week.		

MARCH 1945

## ORGANIZATION FOR TREATMENT OF HEAD WOUNDS IN THE BRITISH ARMY

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Between 5% and 10% of our battle casualties evacuated from the front line are head wounds. Any discussion on organization for their treatment must be preceded by consideration of current methods of treatment, for this is the root of the business - governing arrangements for personnel, their training and the supply, establishment and siting of units etc.

### METHODS OF TREATMENT

Whether working in the forward area or at the base our neurosurgeons are no longer satisfied with less than thorough excision of the wound and primary suture of the scalp. In some brain wounds this cannot be done, but the proportion of unclosable wounds has diminished with modern (fig 1) methods and the use of penicillin.

*Preparations* - A rapid neurological examination is done at all staging posts from the front to the neurological unit, and is repeated before operation. A special head injury card (fig 2) is used for each sep-

arate examination. This is of considerable value in assessing operative priority. Preliminary X-ray examination in two planes is essential, not only to indicate the disposition of metal and bone chips in the brain track but also to unmask the brain wound with in-driven bone fragments and metal beneath a harmless-looking scalp wound.

The whole head must be shaved or inconspicuous wounds may be missed. All operating-room assistants must be taught to shave heads and to keep their razors sharp.

Operation is performed under local or general anæsthetic according to the condition of the patient and the preference of the surgeon. In comatose and semi-comatose cases the upper air passages often contain much mucus, sometimes mixed with blood, in these it is advisable to suck out the nasopharynx and the trachea before operation in order to avoid chest complications later. This is done by the anæsthetist who is also responsible for giving blood and other fluids intravenously if required. One anæsthetist can look after two tables with the help of a trained assistant.

*Post-operative nursing.* - Once a patient has recovered consciousness he rarely gives trouble, but in head-wound wards there are always many unconscious, restless and incontinent patients, and their nursing requires more personnel than in most other wards. For a twenty-four hour service for 40 patients the minimum is 4 specially-trained nursing sisters, 4 V.A.D.s, and 4 nursing orderlies. In approximately one-third of the patients with head wounds there are wounds elsewhere - most frequently in the face and eyes, often by the same missile. Many wounds apparently limited to the eye are penetrating wounds of the brain by way of the accessory nasal sinuses. Hence the neurosurgeon should work in close collaboration with the maxillo-facial, otorhinological and ophthalmic surgeons. Our neurosurgeons are expected to deal with the soft-tissue limb wounds of their own cases, but when many head cases require operation it is advisable to have a general surgeon attached to the head centre to deal with limb wounds.

Cases where a head wound is associated with a penetrating abdominal wound or severe fracture of a limb which cannot be moved for some days, they must be treated at C.C.S. level.

*Later operative treatment of head wounds* - When the immediate danger to life is past reparative surgery is required in some cases.

*Results.* - In 330 penetrating brain injuries admitted in the acute stage from France and Belgium to the Military Hospital for Head Injuries in the second part of 1944, and subsequently observed from two to six months, brain abscess occurred in 17 cases and meningitis in 35 - a total incidence of serious infection of 15%. These cases were primarily operated on, either in Normandy or in Britain, usually within seventy-two hours of wounding, and the scalp was primarily closed in all but 11 cases. Of the 24 deaths in the series, in 22 infection was the sole or predominant cause of death, i.e. a death-rate from

infection of 6.6% or slightly lower if we exclude the patients who died from their injuries before infection developed. Of the 330 cases satisfactory healing (primary or near primary healing) followed in 87%, and brain fungus occurred in only 14 cases. These figures may be contrasted with those of earlier series. Thus in the last war Cushing (1918) operated on 133 brain wounds and 43 of these patients (31%) subsequently died of infection.

In the non-penetrating wounds (i.e. with the dura intact) the mortality is less than 1%, and the rate of return to duty is high. In penetrating wounds of the brain the rate of return to duty is naturally lower; here figures are of little value for they vary with the needs of the Army for men for duty at the base. It is the exception that a man with a brain wound will subsequently fight well as a front line soldier though he may do well in steadier work involving less strain.

To what can the improved results be ascribed? There is no doubt that advances of neurosurgery between the wars have contributed much—such technical improvements as continuous suction, diathermy and fibrin foam for haemostasis, a better knowledge of the means of controlling intracranial pressure and of nursing the unconscious patient. Much has also been learnt from the plastic surgeons concerning closing the scalp where scalp tissue has been destroyed. An important contribution has been made by chemotherapy, in particular penicillin. Lastly there is the contribution of the neurological units in the field.

In the early stages of this war neurosurgeons appear to have been uncertain how far they could go with primary closure: the majority considered that wounds could be primarily closed up to twenty-four hours and after that should be left open. There was incomplete understanding of the overriding importance of débridement, as is shown by the various recommendations for local antiseptics to the undébrided wound. With thorough débridement and chemotherapy we have shown that the scalp can be primarily closed in the vast majority of cases up to seventy-two hours, and often longer.

#### ORGANIZATION

*At home*—On matters relating to head injuries of all types the Director-General is advised by a consultant neurosurgeon and a consultant neurologist. Each looks after his own specialist personnel, in matters of common interest there is the closest collaboration, and there has never been need to define their separate functions.

At the outbreak of war there was set up in Oxford a military hospital of 300 beds for head injuries and other lesions of the nervous system. In the pre-war planning it was assumed that in a modern mechanized army there would be many head injuries from road accidents etc., as well as from battle wounds: in the event the hospital has been continually and fully employed in quiet times with closed head injuries and at other times with gunshot wounds. It has returned large numbers of





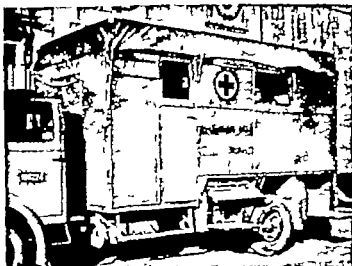


FIG. 3. - Truck for mobile neurosurgical unit. The body is divided into two compartments the front one contains a petrol engine and dynamo, and the back one most of the operating equipment. Beneath the back compartment are seen small boxes into which are loaded the operating table and head rest.

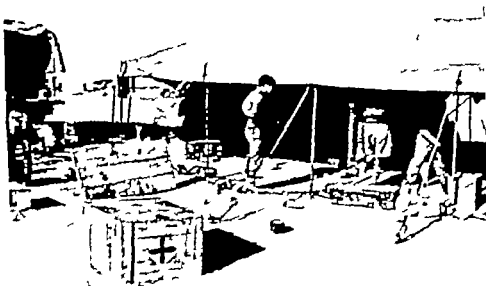
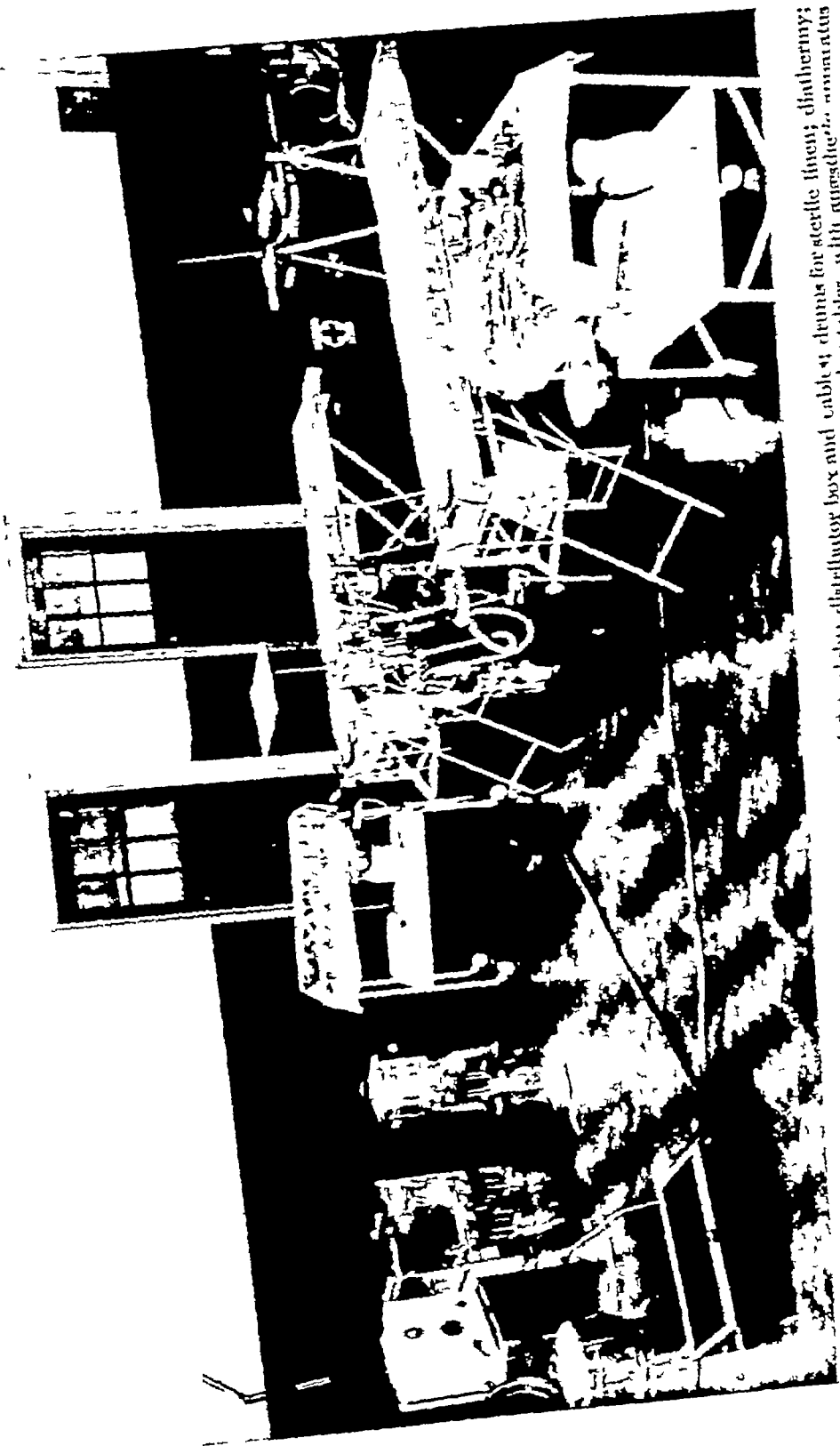


FIG. 4. - Penthouse for operating theatre of mobile neurosurgical unit being set up in Western Desert.



119. 5. - Equipment of mobile neurosurgical unit, showing from left to right: distributive box and cabinet; drums for sterile linen; diathermy; portable light; bowl sterilizer and water sterilizer, with Primus stove; instrument table; two operating tables, with anasthetizer; commutator between them; second instrument table. In the background, a stretcher on wheels, pump, and a vacuum pump.

charge of some 800 wounded. Subsequently in Germany the neurosurgeon of the unit has done work of outstanding merit. Some eighteen months later at Benghazi another neurosurgical unit was confronted with risk of capture, but by then mobility was thoroughly understood the commanding officer continued operating until the unit withdrew intact within a few hours of the Germans re-entering Benghazi (*J R Army med. Cps*, 1942, 78-245).

In this tour of duty in the Western Desert (November 18 1941 to February 1 1942) the unit learned much about mobile surgery in the desert. In ten weeks it worked with C.C.S.s in some eight locations from the Libyan border to Benghazi. The operating theatre was a penthouse 38 feet by 30 feet around a 3 ton lorry (fig. 4). The unit treated over 300 recently wounded men of whom, however, less than 10% had head wounds. As a result the unit was subsequently moved to Cairo where head cases could be segregated but this tour of duty though not neurosurgical, tested equipment and developed desert surgery technique. In this period of experimentation modern mobile forward surgery of the Eighth Army and for that matter of the British Army was put on a firm foundation.

Patients from the battle of Alamein were flown to Cairo where 250 cases were admitted within fourteen days. Some had been operated on in the forward area others arrived untouched. Comparison of the two groups established that it was better to delay primary operative treatment for two to three days in order to get the case to the neurosurgical centre than for a surgeon unused to brain wounds to do a partial debridement within a few hours of wounding (Ascroft, 1943).

After Alamein lines of communication became favourable for early segregation, and another mobile neurosurgical unit was sited with a forward C.C.S. From Alamein to Tunis this unit dealt with over 300 head wounds mostly within twenty four hours of wounding (Eden 1943). When a forward base was established at Tripoli the unit was split into advance and rear sections. Thus practically all head wounds were treated by the neurosurgeons. The work of the forward team was lightened, as they could transfer cases to the rear section by air the milder without, and the severe soon after, operation. These patients were found to travel well by air.

It has now become common practice to split mobile neurosurgical units into forward and rear sections. The original basic equipment suffices, with additions such as extra diathermy and suction, but personnel are rather thinly spread, for this reason the establishment of the units has been recently reconsidered.

This pioneer work in North Africa established the position and functions of mobile neurosurgical units and assured their place in the order of battle.

The Italian campaign brought a new development - the methodical association of the neurosurgical units with the more recently formed

maxillo-facial and ophthalmological units. This was a great advantage in treatment of the many head wounds involving the face and eyes, and it was a great convenience to forward units responsible for sorting and evacuation. This trinity is now firmly established in most of our Armies.

In the Normandy campaign, a British unit and a Canadian unit dealt with large numbers of cases. My remarks are limited to the work of the British unit. In Normandy the volume of work exceeded anything we had before encountered, as many as 50 patients might be awaiting treatment at any one time. Air transport became available soon after the beginning of the campaign, and about half the cases were evacuated without operation to neurosurgical centres in U.K., the great majority arrived within forty-eight hours, some on the day of being wounded, the remainder were operated on by the neurosurgical unit in Normandy.

Early evacuation of unoperated head cases requires the most careful sorting, and this is usually the function of the medical neurologists attached to the neurosurgical units. It may have to be done without X-ray studies, and it calls for a special clinical skill, most easily acquired by neurologists who have had some training in neurosurgery. Of over 2,000 head cases evacuated from Normandy only 3 died in transit.

Of 1,000 head cases evacuated from Normandy to U.K. by air before or one to three days after operation, 16 developed collapse of the lung, and of these, 7 had had no operation. All were inert, no restless patient developed this sequel. It was concluded that this complication was due not to a recent operation, but to the fact that inert patients lie too long in one position on the stretcher. Clearly all inert types require frequent slight alterations of position during transit, and instructions have been issued accordingly.

During August 1944, in Normandy, an advance section of the neurosurgical unit worked at C.C.S. level, one-third of its patients had head injuries combined with severe injury elsewhere. Such patients could not be moved and their segregation, even in the forward area, is usually impossible. The peculiarly favourable conditions of wound clearance in Normandy revealed the importance of this problem, and gave further support for the view – held for some time by our neurosurgical units – that a high mortality rate, if it means anything, indicates good clearance of wounded from the forward area, whereas a low mortality rate after early operation for brain wounds certainly means that evacuation and subsequent segregation of wounded have not attained the highest standards.

In the Burma-Assam campaign of 1944 one of our neurosurgical units treated some 350 gunshot wounds of the head. In the mountainous jungle, lines of communication were difficult. Wounded had to be brought along shallow rivers in native boats or outboard motor-boats, over hill-tracks by mule, and along tortuous single-track roads. The majority did not reach the head centre until the fourth day or later.

after wounding. Though operating was done at night, few patients could tolerate operations under local anaesthesia in such heat and humidity for it was more than they could bear to lie under operating towels for an hour. When the monsoon broke it became more possible to use local anaesthetics. Dust and flies abounded. Of 167 penetrating wounds 30% showed frank pus on admission, and a further 10% showed it later. In the climate of Comilla it was impossible to close wounds more than four to five days old though it could be done at Imphal. There were many special problems e.g. whether a Sikh would be allowed to return to his regiment without disgrace and degradation if his scalp had been shaved; how to restrain the African native from removing his head bandage and the tube in his brain abscess for a morning dip in the water tank; how to prevent the Indian from wriggling out of his plaster bandage; how to administer sulphonamides where there is so much sweating that a large proportion of patients on full doses of sulphadiazine will rapidly develop dysuria, and if they are Gurkhas or Africans will not complain. All questions of supply were especially difficult.

*The human factor*—There are undoubted advantages in a small unit: it is flexible and can be quickly adapted to exigencies; all ranks become competent in technical matters, e.g. handling surgical equipment, generators, vehicles, etc. However the small specialized unit, from the point of view of central organization must be something of a nuisance, though no hint of this has ever been displayed at the War Office. In the field the neurosurgical units move from one parent unit to another whether a C.C.S. or general hospital of 200 beds or larger. Each of these is expected to supply operating theatres, ward space and general help which may sometimes put strain on the parent unit. There are many small units to be looked after in the same way as neurosurgical units and parent units recognize their responsibilities.

*Neurosurgical training for general surgeons*—In most campaigns the mobile neurosurgical units have dealt with a high proportion of the head wounds (Normandy over 90%). However it is not always possible to get head cases to them in time for primary surgical treatment. There are not, and never could be, enough neurosurgical units to staff the whole forward area and there are patients with multiple wounds who cannot be moved for some days. In addition, it has not always been possible to segregate even uncomplicated cases e.g. in 1940 in France, and the battles before Alamein. Recognizing that, particularly in the early phase of an operation, this state of affairs may be inevitable, the War Office and the civilian neurosurgeons have attempted to develop training schemes in U.K. in head injury work. For a variety of reasons these attempts at training in U.K. have never been a success. Meanwhile, however in the commands overseas more effective training has been developed: during a rest period out of the line the F.S.U. surgeon is attached with his team to a near by neurosurgical unit for three weeks or

so; they take part in primary operations on head wounds and quickly learn to handle neurosurgical tools and to do a workmanlike excision and primary suture of the average brain wound. So far this scheme has functioned in a small way, but has proved so satisfactory that the War Office has arranged for its more systematic application in distant theatres of war, and hopes eventually to have neurosurgically-trained and equipped F S U s with every Army Corps. These units will continue to do general surgery but will operate on such patients with head wounds as cannot be evacuated promptly to the neurosurgical units. The majority of the head wounds will continue to be dealt with, whenever possible, by the mobile neurosurgical units.

Thanks mainly to air evacuation and chemotherapy, it has been established beyond question that it is feasible in most battles to act on the rule that the primary brain operation should be definitive and final—a thorough excision of the wound and primary two-layer closure of the scalp, with or without the closure of the dura. This operation is worth waiting for, and in most brain wounds can be delayed for up to seventy-two hours. Speaking generally, the greater the distance behind the lines the greater the facilities for this operation, and the more time at the disposal of the surgeon. But we must still prepare for the same type of operative treatment at three levels.

(a) At the most advanced surgical centres operations must be done on cases which cannot be moved, the operation may be undertaken, according to circumstances, by a neurosurgically trained F S U surgeon or by the advance section of a mobile neurosurgical unit.

(b) *At the overseas base (forward or rear)*—Here the head cases should be segregated. The policy here varies considerably according to circumstances: sometimes the most severe cases are operated on and the rest evacuated, at other times all cases are operated on and all but the most severe are subsequently held and are returned quickly to duty without going down the line.

(c) *In U K*—Always the guiding policy should be to send the severely wounded as far back as possible for operation—it is perhaps not yet sufficiently realized what air transport can do. In 1943 head cases were flown to Tripoli from Salerno for primary operation. The unit in Tripoli was in process of moving to Sicily, and a day or so after this move some 12 head cases arrived in Tripoli by air, they were then flown 1,000 miles to Cairo where they received expert neurosurgical treatment only twelve hours later.

There is little doubt that the most urgent contribution to present medical organization for treatment of head wounds would be improvement in the facilities for air evacuation.

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MARCH 1945

## TREATMENT OF NEUROSURGICAL CASUALTIES IN THE FIELD

MAJOR C. C. GRAY R.C.S.M.C.

A neurosurgical team, the first of its kind in the Canadian Army, was formed in April 1944 on the pattern of the British neurosurgical teams.

The unit arrived in Normandy during the third week in July and were functioning at the time of the Caen and Falaise battles. Subsequent moves, six to date have taken us through France and Belgium into Holland.

It has been impossible to formulate any fixed plan of working because conditions have varied so much. The unit has functioned as close as 6 miles behind the front line and as far back as 150 miles. It was soon realized that the best position for the smooth functioning of the unit was in the forward 600 bed hospital, with its adequate facilities. At times we found ourselves completely out of the picture and on more than one occasion we were primarily responsible for initiating a move to a more suitable location.

*Reception of casualties*—Before reaching the neurosurgical centre, the casualty usually passed through the RAP CCP ADS or FDS and a CCS or 200 bed hospital, travelling in stages by motor ambulance. When located close to the front line, the wounded were admitted directly from the RAP. When far behind the fighting zone the head or spine casualty frequently was evacuated to the neurosurgical centre by means of the Shuttle Air Evacuation Service. The majority of allied casualties reached the special centre within twenty four hours and only



rarely more than forty-eight hours from time of wounding. Prisoners of war arrived at any time up to eight days after being wounded.

Despite the memoranda and circulars pointing out the proper method of transporting the unconscious patient in the semi-prone position, neurosurgical casualties have arrived tied down to the stretcher, lying flat on their backs, airways blocked by retracted tongues or by accumulated mucus and vomitus, or they would be admitted face down with mouth and nose being buried in mucus, blood or even soft pillows. However, this was uncommon considering the numbers being evacuated. It has long been pointed out that the head casualty travels well and in general this was found to be true.

*Resuscitation.*—It is usually stated that patients with head injuries are not shocked unless suffering also from associated major injuries. This statement is not wholly true as we have had patients with penetrating head injuries only, showing obvious signs of a state of oligemic shock and a hematocrit reading below 30%. The common belief, that cases with head injuries should not receive intravenous fluids, generally speaking, is incorrect. They should be treated for shock with blood and blood substitutes, though the signs of this state may be different from those found in the patient suffering from a compound fracture of the femur. The soldier with a head injury showing signs of shock is often evacuated to a special centre when supportive therapy plus intravenous therapy in the forward unit would increase his chances of survival. It has been observed that the penetrating head wound is not a surgical emergency and in fact the condition of these casualties often improves following a twelve to twenty-four hour period in a warm bed with rest and fluids. The only cases on our service that were considered for immediate surgery were those with signs of a space-occupying intracranial haemorrhage.

*Pre-operative treatment and classification* —Ideally we had two wards, a pre-operative and resuscitation ward and a post-operative ward. Cases were admitted to the former ward on a stretcher where they were left pending decision for immediate X-ray, evacuation, operation or resuscitation. Casualties fell broadly into four groups —

- (1) Moribund on admission or with extensive brain damage and little chance of recovery
- (2) Needing resuscitation and operation
- (3) Suitable for pre-operative evacuation to United Kingdom
- (4) Minor scalp wounds which were evacuated to base for treatment by the general surgeon.

In this latter group an X-ray was usually taken to rule out a small penetrating wound in a silent area. It was felt inadvisable to probe all scalp wounds routinely because of the danger of introducing infection while a small penetrator might still be missed. Group 3 were usually

conscious patients with minor penetrators, fronto-naso-orbital wounds, and temporo-auro-mastoid wounds. They were only evacuated when pressure of work was such that it was impossible to handle all cases admitted to the service. Air evacuation made this a practical plan and often cases were operated on in U.K. long before they would have reached the operating theatre in our own unit.

In the first group owing to lack of experience, in the early stages of the campaign we toiled long hours with blood, plasma oxygen, and stimulants to no avail. It was arbitrarily decided that if after receiving one bottle of plasma and one bottle of blood the patient showed no improvement in a period of two to four hours, then further resuscitation would be of no value. Bad prognostic signs were —

(1) Absent corneal reflexes. (2) Choked discs and retinal hæmorrhages becoming evident within twenty four hours of the time of wounding (These were observed as early as twelve hours after injury) (3) Stertorous irregular breathing (4) Decerebrate fits. (5) Hyperpyrexia. (6) Slow pulse in an already decompressed penetrating head wound

For the group that were to undergo surgery in our unit we gave blood, plasma and oxygen if indicated. All cases received prophylactic doses of penicillin, 50,000 units intramuscularly as an initial dose followed by 20 000 units every four hours. In addition, they were given 50,000 units immediately pre-operatively and 50 000 units at time of evacuation. All received sulphadiazine by mouth if conscious and not vomiting or by intramuscular injection. This drug was given in an initial 2 gm. dose followed by 1 gm. every four hours. Intrathecal penicillin was given only to the occasional ventricular 'penetrator' to those cases in which the surgeon encountered infection or therapeutically to those who developed post-operative infection while still under our care. The daily dose was 25 000 units intrathecally

These cases received excellent nursing care with especial regard being taken to their skin and to their feeding. Pre-operative X rays were taken but only single films in two or three planes were available. The sorting of patients and arranging the operating lists were the responsibilities of the medical officers who worked on the wards. Often the surgeons saw their cases for the first time on the operating table.

On our establishment there were two neurosurgeons and two theatre sisters, who could have worked in twelve hour shifts, but there was only one anaesthetist and an inadequate number of operating room assistants to keep the operating theatre functioning steadily twenty-four hours a day. The most satisfactory scheme was to use two tables at the same time, one table carrying a major case under endotracheal ether and the other a minor 'penetrator' under local anaesthetic or a more severe wound under intravenous pentothal anaesthesia. By this method as many as 10 penetrating wounds of the head could be handled between the hours of 9 in the morning and 11 in the evening by the two surgeons, and the single anaesthetist.

*Post-operative care and evacuation* – The post-operative care entailed the continuation of resuscitation methods when necessary, regular prophylactic chemotherapy, tube feedings where indicated, assurance of an adequate airway, and special nursing care. Simple ‘penetrators’ and the more severe cases who were conscious were evacuated by air to the U K within twenty-four hours of operation. Only the very severe cases were held over seventy-two hours. This rapid evacuation was necessary during a busy period. The scalp lacerations and closed head injuries that came to us during less active periods were evacuated to base units with a view to the soldier returning to duty at a later date. Evacuation by sea was used by the neurosurgical unit only for P o W s and before permitting a sea voyage it was felt advisable to hold these cases for five to seven days.

*Spinal injuries* – Our policy is similar to that prevailing in the British Army. Surgical interference, with a few exceptions, is limited to a supra-pubic cystotomy. Such cases are then considered as suitable for immediate air evacuation to a spinal centre in the U K, because they present such a serious nursing problem in the field. When possible these cases were evacuated lying, with a rubber air ring under their sacrum. As a result of the present policy many paraplegic patients do not reach the neurosurgical field unit but instead have their supra-pubic cystotomy performed by a general surgeon and are then evacuated directly to the U K. The exceptions to the above policy have been partial lesions, particularly those involving the cauda equina, when root pains predominate or in cases where the signs showed definite indications of progression of the lesion. When these conditions prevailed laminectomy was performed.

Peripheral nerve injuries have not been sent to the neurosurgical units on the Continent.

*Associated injuries* – Roughly 40% of all cases with head wounds have other wounds of the body, but in our series only 10% of the cases have a serious associated wound. A maxillo-facial unit has always worked in conjunction with the neurosurgical unit, and an eye surgeon has usually been available, but the association with a general surgeon has been most important. Not infrequently, the treatment of the associated injury took priority over the head wound.

*Statistics* – During the month of February, a 28-day month, 372 cases were admitted to the neurosurgical service. 226 of these cases were treated surgically (during the first seven days of month only 6 cases underwent operation). Approximately 60 of these cases were considered as minor surgical problems. There were in addition 40 odd ‘penetrators’ evacuated pre-operatively for treatment in U K. Mortality statistics at our level are fallacious, but for what they are worth – our overall mortality runs around 12 – 14%, while the post-operative mortality is about 8%. During February, when rapid

evacuation was being carried out, the mortality figures post-operatively fell below 6%. During slack months the post-operative mortality rose because the more serious cases received greater attention along lines of evacuation and at our centre, and were subjected to surgical treatment whereas during busy spells they would never have reached the operating table. In addition they were kept for a longer period of time post-operatively.

APRIL 1945

## TREATMENT OF MAXILLO FACIAL INJURIES IN THE R A F

SQUADRON LEADER T CRADOCK HENRY R.A.F. V.R.

*Injury* - R.A.F. personnel are sharply divided into two groups - ground staff and aircrew. The latter are exposed to the hazards of flight, complicated in operations by enemy action. It is, therefore, reasonable to suppose that aircrews are liable to two types of facial injury -

(1) Those peculiar to flying - namely (a) deceleration injuries, (b) propeller injuries (c) burns (d) frostbite.

(2) Injuries, common to all fighting services, conveniently termed gunshot wounds.

These two groups of injury can frequently combine, thus a minor flak wound may cause a pilot to lose control of the aircraft, bale out or force land, with the possibility that this will add one of those injuries of flying with more serious consequences.

The term front line is hardly applicable to the aircrew. Should accident or injury occur over enemy territory the pilot will make every effort to return to base. Hence, injured personnel are usually first treated either in a mobile field hospital or in a station sickquarters, both of which are usually so situated that it is comparatively easy to transfer patients to a large and specially equipped Base Hospital if necessary the highest priority in air transport being given to maxillo-facial injuries and burns.

*General treatment and transport.* - The high proportion of multiple injuries in flying accidents are accompanied by profound shock. Thus in a series of 7 932 cases of injury sustained in flying 5,469 were multiple and 1 053 were in the face or head. It is therefore particularly important to consider carefully both first-aid and transport. If air transport is available and the journey not long immediate transfer is indicated, providing the injuries have been roughly ascertained, and

hæmorrhage or respiratory embarrassment are unlikely Morphine should be administered prior to transfer To keep in station sick-quarters a seriously ill patient, whose general and local conditions both need attention, is courting disaster, as transfer cannot usually be undertaken until secondary shock has been overcome

Among the multiplicity of injuries which tend to occur in aircrew, there is a high proportion of head injuries Thus in 3,028 injuries of the head or face 2,186 were regarded as predominantly head injuries This differs, in my experience, from gunshot wounds, where survivors tend to show injury of the face or head but not both It is necessary, therefore, in all deceleration injuries of the face to be constantly alert for symptoms and signs of associated head injury

The typical injury in aircrew is fracture of the middle third of the face Three types are significant in regard to function

(1) The malar-maxillary fracture which may result in loss of orbital floor, enophthalmos, and, by direct injury to one of the extrinsic muscles, may cause permanent diplopia

(2) The naso-maxillary fracture in which displacement or crumpling of the septum will obstruct the airway – a matter of great significance in flying

(3) Fracture of the tooth-bearing segment with resultant malocclusion

The mandible is rarely fractured in comparison with the middle third; of 487 injuries of the middle third and the mandible, only 34 were fractures of the mandible Where fracture of the mandible has been recorded comminution has usually been severe and more than one fracture present

*Soft tissue injuries* – Severe soft tissue injuries are rare in those that survive to be admitted to hospital, with the obvious exception of burns and combined injuries In the R A F this is common and these injuries constitute the more difficult problems, on account of life and in regard to future function

*Treatment* – This follows accepted procedure In middle third injuries the antral approach to the orbit is commonly used and fixation obtained by antral pack Sometimes direct fixation has been necessary, if severe displacement has occurred, the use of steel wires or suspension of the mandible by the head cap Fractures involving the mandible are almost universally treated by the use of cap splints If for any reason it is not possible to use these, other means, such as interdental wiring, are employed, as we do in the U.S.A. The use of steel wires for fixation of the mandible is also common in the U.S.A. and in the R A F

Acute obstruction of the airway may be due to the falling back of the tongue, loose fragments of bone, blood clot, broken dentures, foreign bodies, etc. An attempt should be made to remove the cause as soon as possible. Pulling forward the tongue by means of a suture will restore the airway but to rely only on this procedure is to court disaster. By keeping the tongue pulled forward, deglutition is prevented. There is, therefore, an increased tendency for the patient to inhale debris and blood. If such a state of affairs is allowed to persist, there is every chance that a condition of subacute obstruction will be introduced.

Once the cause of the acute obstruction has been removed, the patient must be placed in the prone position, face downwards. By doing so, the tongue will fall forwards and, what is equally important, debris and blood will drain out of the mouth, and not into the pharynx. This position must be maintained throughout nursing and evacuation.

No reference will be made to those cases of acute respiratory obstruction which require a tracheotomy as they are a surgical and not a dental problem.

Subacute respiratory obstruction, it has been pointed out, is mainly caused by lack of deglutition, which latter may be due to keeping the tongue pulled forward, a collapsed mandibular arch, or a wound of the floor of the mouth, pharynx, etc. Again, the patient must be placed face downwards in the prone position.

(2) *Making the mouth comfortable* — This may be considered under three headings, namely —

(a) *Oral hygiene* — This is too well known to require further notice.

(b) *Dental surgical procedures* — No traumatic bone surgery such as the extraction of firmly implanted teeth, should be undertaken until a complete assessment can be made, including X ray examination. It is not until the casualty clearing station is reached that X rays are available. This means that the extraction of teeth should be confined to obviously loose or partially dislocated teeth and the removal of fractured crowns that are causing discomfort. For the same reason, removal of bone fragments is confined to completely detached fragments that are causing discomfort to the patient. No other bone removal is justified at this stage.

Rough edges of fractured teeth and sharp edges of bone should be smoothed and exposed pulps treated by an application of pure phenol. Where fillings have been dislodged a sedative dressing should be inserted.

It is seldom necessary to undertake any fixation of bone fragments by intra-oral methods of wiring at this stage. Should immobilization be advisable, it is best applied with premedication and supplemented with local anaesthesia when conditions are favourable.

(c) *Extra-oral support for the jaws* — All cases of complete fractures of

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## DENTAL TREATMENT OF MAXILLO-FACIAL INJURIES IN FORWARD AREAS

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The words 'Forward Areas' are used here to indicate field ambulance and casualty clearing stations, these being the levels at which the earliest surgical treatment is possible.

The problem as presented to the medical and dental officers in these situations is the initiation, by simple means, of successful treatment of these wounds involving the jaws, which may vary from a simple fracture to an extensive loss of bone, associated with varying degrees of soft tissue injury.

### TREATMENT AT THE FIELD AMBULANCE

At this level surgery should be confined to life-saving measures only. There are many reasons why this is so. First, the facilities at a field ambulance for post-anæsthetic treatment are limited and the policy is not to overcrowd such a unit with immovable cases because room is wanted for the accommodation of further casualties. Secondly, a field ambulance rarely offers the facilities for elaborate treatment of these injuries.

Under these circumstances, the treatment by the medical and dental officers is confined to : (1) The maintenance of an airway. (2) The treatment of hæmorrhage. (3) The treatment of shock. (4) Making the patient comfortable and fit for evacuation to the nearest maxillo-facial surgical unit as soon as possible.

Hence quite a number of cases require little or no treatment and can therefore be evacuated immediately. The dental officer's responsibilities with regard to those casualties which are detained may be summarized as follows in addition to making legible notes of any injury to the dental structures together with details of any first-aid given.

(1) *Maintenance of the airway* - There are two types of respiratory obstruction that occur in these injuries, namely, the acute and sub-acute, and the dental officer must know the appropriate means of relieving them.

Acute obstruction of the airway may be due to the falling back of the tongue, loose fragments of bone, blood clot, broken dentures, foreign bodies, etc. An attempt should be made to remove the cause as soon as possible. Pulling forward the tongue by means of a suture will restore the airway but to rely only on this procedure is to court disaster. By keeping the tongue pulled forward deglutition is prevented. There is therefore an increased tendency for the patient to inhale debris and blood. If such a state of affairs is allowed to persist, there is every chance that a condition of subacute obstruction will be introduced.

Once the cause of the acute obstruction has been removed, the patient must be placed in the prone position, face downwards. By doing so the tongue will fall forwards and what is equally important, debris and blood will drain out of the mouth, and not into the pharynx. This position must be maintained throughout nursing and evacuation.

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It is seldom necessary to undertake any fixation of bone fragments by intra-oral methods of wiring at this stage. Should immobilization be advisable, it is best applied with premedication and supplemented with local anaesthesia when conditions are favourable.

(c) *Extra-oral support for the jaws* — All cases of complete fractures of



the mandible, however simple, should have some form of external support. It matters little what form of support is given provided that it pulls in an upward and not backward direction, and also is firmly applied. The barrel bandage is simple to apply and is perfectly satisfactory if several turns are taken underneath the chin to give the required support, being finally strengthened on the outside by elastoplast reinforcement.

*Maxillary fractures* – A word must be said about maxillary fractures, particularly with reference to the type commonly referred to as the 'Floater,' that is to say when the tooth-bearing segment is displaced downwards.

Under no circumstances should the Kingsley pattern splint be applied. It is really a Hayward splint designed for use in mandibular fractures which is obvious when one examines the curve of Spee. If it is used, the patient in closing his jaws will hit the tray with his mandibular molars thereby causing a constant rocking of his maxillary fragments.

Leaving the fracture alone is by far the better of two evils and the patient should be evacuated to a maxillo-facial unit as soon as possible.

#### TREATMENT AT THE CASUALTY CLEARING STATION

Here the facilities for examination and treatment are much better than at the field ambulance and the amount of treatment undertaken at this level will depend upon the distance to the nearest maxillo-facial surgical unit. If this latter unit is not far away, the same principles of treatment as previously outlined for the field ambulance first-aid still apply at the C C S. Life-saving measures only should be undertaken and the patient evacuated as soon as possible.

If, however, the maxillo-facial surgical unit is a long distance away some form of definitive treatment may have to be undertaken, and in such cases the dental officer's first responsibility is to make a thorough clinical examination, with a subsequent X-ray examination.

*Definitive treatment* – The steps in definitive treatment may be considered under the following headings.

(1) *Extraction of teeth* – As a general rule teeth in the line of fracture should be extracted, in order to reduce to a minimum infection of the fracture line. When considering the extraction of teeth during the field ambulance first-aid treatment, advice was given to avoid such undertakings if possible. At this level the dangers of so doing are still present. The decision as to whether or not to extract a tooth in the line of fracture is dependent upon the following considerations: (a) Will undue trauma be inflicted by the extraction? (b) Is the tooth firmly attached to a useful and viable fragment of bone? (c) Is the presence of the tooth necessary for the control of the fragment?

If on weighing up the evidence there is no valid reason for retaining

the tooth, it should be extracted otherwise extraction may be delayed until a more favourable occasion provided it is watched with care.

In those casualties where the injury is confined only to fracture of the teeth and alveolar process, the tooth and bone fragments should all be removed, and if no infection is present the wound closed by primary suture. By this means considerable time can be saved in replacement by artificial dentures.

(2) *Removal of bone fragments* - The procedure to be adopted in comminuted gunshot fractures of the mandible seems to be a contentious point, but the issue is fairly clear and may be summed up as follows. If it is obvious from the outset that a bone graft will be necessary at a later date, then all comminuted bone should be removed. If, however, any doubts exist as to whether a bone graft may be necessary, the greatest caution in the removal of bone fragments should be observed and only those which are completely detached or may be considered non-viable should be removed.

Bound up in the question of bone removal is the problem of drainage. Again, as a general rule, all comminuted gunshot fractures of the mandible should be drained externally and the drainage must be adequate and dependent.

(3) *Intra-oral splinting* - No cast metal cap splint should be applied in the forward areas unless it is undertaken by a specialist unit. The reason is that any cast splint that is cemented must be so designed and constructed that it does not have to be removed on arrival at the maxillo-facial surgical unit, but can be used throughout further plastic treatment.

Consequently the dental officer at the C.C.S. must use simple methods of intra-oral wiring and vulcanite or acrylic splints wired to the alveolar process. In capable hands, considerable value can be obtained from these. Splints wired to the alveolar process do not travel well during long evacuations over bumpy roads but by attaching an external rod to the splint and thence to a plaster-of-Paris head cap this drawback is easily eliminated. Another and more simple method particularly for edentulous maxilla is to attach wire Kingsley extensions and wire lugs to the upper denture, or an acrylic base if the denture is lost. The Kingsley extensions are secured on the outside of the face to a linen operating headcap by means of tapes. The wire lugs are used to secure intra-oral reduction and fixation of the mandibular fragments the latter having had eyelet wires applied.

Where it is intended to attach inter maxillary fixation, one must ensure that there will be an adequate airway on completion of the fixation, since there are conditions which may give rise to respiratory embarrassment if the jaws are held together in occlusion. Nasal obstruction, oedema of the tongue and penetrating wounds of the chest are a few examples.

Some controversy has been raised concerning air sickness and the desirability of inter-maxillary fixation. There is no danger in sending by air patients who have their jaws fixed in *occlusion*. All such cases are fed on a liquid diet, thus any vomit will be of a fluid nature, and from past experience one has yet to hear of a maxillo-facial patient vomiting, let alone any danger arising from such cause.

### CONCLUSION

From this brief survey it would seem that the dental treatment of these injuries by the dental officers in forward medical units is limited. This is mostly because of the lack of facilities due to operational circumstances, and also of the impossibility of supplying all these units with the elaborate special equipment which is required for maxillo-facial surgical units.

For these reasons one is a strong advocate of a mobile specialist team working well forward whereby the treatment by experienced personnel with the necessary facilities and equipment is brought to the patient and not vice versa.

This formation was successfully tried out in the Italian campaign, and there is reason to believe that arrangements have been made in the 'Far Eastern' campaign for each corps to have a maxillo-facial mobile dental unit.

Whatever facilities exist for the treatment of these casualties, dental officers in forward medical units can do much to minimize the discomfort of the patient, and make the task easier for the specialist unit which undertakes the later treatment.

APRIL 1945

## TREATMENT OF MAXILLO-FACIAL INJURIES

SIR HAROLD GILLIES

The first point that cannot be too strongly stressed is the *positioning of the patient*. It can safely be said that over 80% of deaths following maxillo-facial injuries are due, at some time during their treatment, either to acute or to chronic suffocation. The patient must be placed in such a position that his tongue tends to gravitate forward and blood and mucus come out of the mouth. Further than that a ticket should be labelled on him to maintain this position. In fact on a stretcher case I would recommend a label as follows - 'You will kill me if you turn me over on my back' or 'If I can see heaven, I'll soon be there'.

As regards the morale of these patients, they should each be informed that they are all right, and that they will be able to speak, and to eat, and will look reasonably well when the repair is finished. Even a

person with a trivial maxillo-facial injury is inclined to imagine in the first instance that he is a ruined man. I remember a Canadian Officer in No 6 M.F. Unit who had had a severe blow-out of the jaw and base of tongue. I had seen the operation and I went in to see what the ward handling was like. The patient was sitting up properly in bed and was able to control his saliva. To cheer him up I told him he would eventually look well and eat well. He was still worried because I did not tell him that he would speak well again.

Following the case down the line to C.C.S. and hospital and still on this question of asphyxia, all the M.F. units have reported from time to time during a battle phase the death of a patient who was not seriously injured but who a few hours after his operation developed sub-acute anoxemia and died in bed without anybody knowing anything about him. In the words of the officers commanding these units 'These patients have died through lack of attention. This happened also in the unit I worked in during D-Day time, before the Army units got going in Normandy, when to all intents and purposes we were acting as a first hospital to which patients came.

Clarkson (No 4 M.F.S.U.) has drawn particular attention to the fatal risk of chronic or sub-acute anoxemia in the post-operative period to the fact that these deaths are avoidable accidents, and to the vital need of anesthetic services of the first order and a well lit recovery room - particularly in battle periods.

However, great improvement in the post-operative death rate has occurred in this war due to the enormous improvement in anaesthesia, in the development of the physician-anaesthetist, and in the chest care and transfusion needs of the patient.

Another question is the feeding of these patients in transport. The Ryle tube is an excellent means and should, if properly used, keep even cases with the most extensive jaw wounds from being unduly hungry. However, a considerable proportion of heavy jaw cases arriving in the United Kingdom complain bitterly of being hungry on arrival. This can be traced to various causes

(1) The nature of the injury and the difficulty in swallowing and in feeding

(2) Tracheotomy tube pressing on the oesophagus.

(3) A nasal tube put in to maintain an airway and left in.

*What is the value of early fixation and how much fixation should be done?*

It became clear in the North African Campaign that elaborate forward fixation for the upper jaw which could not be completely done at that level, was a mistake.

One noticed the same tendency to over-elaboration of apparatus in the early stages of the Normandy battles, much of which had to be cast aside on arrival in the United Kingdom because the first special treatment could not in the circumstances be complete. Later, when

Some controversy has been raised concerning air sickness and the desirability of inter-maxillary fixation. There is no danger in sending by air patients who have their jaws fixed in occlusion. All such cases are fed on a liquid diet, thus any vomit will be of a fluid nature, and from past experience one has yet to hear of a maxillo-facial patient vomiting, let alone any danger arising from such cause.

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## VASCULAR INJURIES IN BATTLE CASUALTIES

COLONEL CHARLES B. ODOM, M.D. F.A.C.S.

*Surgical Consultant, Third U.S. Army*

In some quarters, particularly among men who have not seen battle casualties in the field, there seems to be an impression that many of the amputations performed in this war could have been avoided if surgical procedures they advocate had been applied. These methods include the application of sympathetic block, sympathectomy and methods of vascular repair. The battle casualties in which vascular injury was the paramount lesion comprise a much smaller group than many surgeons suppose. Of 92,030 battle casualties there were only 837 such cases or 0.9%. Of these 837 injuries to major arteries 423 cases came to amputation and the main vessels involved are shown in the table below.

TABLE I - BLOOD-VESSEL INJURIES WHICH LED TO GANGRENE AND AMPUTATION

<i>Arteries</i>	<i>Number of cases</i>
Subclavian	4
Axillary	18
Brachial	80
Cubital	2
Radial	2
Ulnar	1
Radial and ulnar	3
Common iliac	6
External iliac	7
Femoral	104
Popliteal	157
Anterior tibial	3
Posterior tibial	16
Anterior and posterior tibial	20
Total	423

The surgeons of this army were thoroughly indoctrinated with the importance of attempting repair of major vascular injuries. A report by Arthur Blakemore [3, 4] and his associates on the non-suture repair of blood vessels was reproduced and a copy placed in the hands of every chief of surgery and surgical team chief.

The vitallium tubes and heparin necessary for application of their method were not available in large quantities, but there was sufficient material to give the method a fair trial. It was the consensus of opinion that some of the procedures advocated by Blakemore are impractical for use in the field. These include the following points: (1) The recognition of injury to a major vessel by an aid man on the battlefield

the M F units were better housed and had more time, everyone who works at these units (and there are 14 or 15 centres in Great Britain) has been amazed at the excellent condition in which these patients have arrived home

*Surgical treatment of the bone injury* – There is great difficulty in deciding what pieces of mandible should be preserved, and what should be excised. If the bone fragment has a good blood supply and is firmly attached, by all means it should be left, particularly if there is a good and reasonable chance to get bony union.

Before criticizing surgeons for being too free in their removal of comminuted pieces, it is important to remember that bone grafting with medullary chips is so certain that it is justifiable to be more radical and create more early bone gaps than was previously wise.

The incidence of infection, of sequestration, and of secondary hæmorrhage, all depend on the thoroughness of the early surgery. The bugbear of secondary hæmorrhage has been conspicuous by its absence, which one must attribute not to chemotherapy alone, but to the thorough surgery that has been done by the Army.

Some very early bone grafting has been done, even on the second day. This on the whole has not been a success, not only because of the clinical, but also because of the military difficulties. The clinical difficulty lies in the inability of the surgeon in an individual case to get a good closure of the mucous membrane of the mouth, which is a notoriously difficult suture.

*Soft tissue treatment* – The principle of suture of skin to mucous membrane round the marginal defect must be encouraged when direct suture is not available. It is one of the most valuable of all instructions which should be given to surgeons doing the early surgery.

The provision of a forward maxillo-facial section has amply justified itself. Captain Rex Lawrie's (No 4 M F S U) paper on 'Early Suture' in Italy is a strong pointer in favour of this principle. A high percentage of his facial injuries returned to duty without going to the base, while the more serious were excised, closed in layers, healed within ten days and were evacuated to main maxillo-facial section at main base, Naples. The forward trinity, of the neurosurgeon, the ophthalmologist and the maxillo-facial surgeon, did most excellent work.

TABLE III. - INJURED VESSELS TREATED BY LIGATION

Artery	Number	Viable	Gangrene	/ developed gangrene
Subclavian	9	3	4	44
Axillary	29	15	14	48
Brachial (above profunda)	69	32	37	53
Brachial (below profunda)	141	108	33	23
Cubital	4	2	2	50
Radial	25	23	2	8
Ulnar	22	21	1	4.5
Radial and ulnar	8	3	3	37
Common iliac	6	1	5	83
External iliac	6	2	4	66
Femoral (above profunda)	74	12	62	84
Femoral (below profunda)	62	27	35	56
Popliteal	196	51	145	74
Anterior tibial	21	18	3	13
Posterior tibial	69	53	16	23
Ant. and post. tibial	26	6	20	76
Total	767	381	386	50

In order to emphasize the marked difference between the problem encountered in the surgical care of vascular injuries in battle casualties and those met in comparable injuries in civilian practice, the table below is produced. The figures in column two are taken from a monograph on vascular injuries produced for the guidance of military surgeons by the Committee on Surgery of the National Research Council [2]

TABLE IV - SUDDEN ARTERIAL LIGATION AND GANGRENE

Artery ligated	/ developed gangrene Battle casualties	V.R.C. chart	%
Subclavian	44		9
Axillary	48		9
Brachial	55		3
Cubital	50		0
Common iliac	83		50
External iliac	66		13
Common femoral (above profunda)	84		21
Femoral (below profunda)	56		10
Popliteal	74		0
Anterior tibial	13		3
Posterior tibial	23		3

These marked variations in results are not due to a difference in treatment. The major difference, it is felt, can be found in the fact that the battle casualty has had his injury for from six to twelve hours before he gets to surgery. He is exsanguinated, has a low blood pressure, and is in shock. His tissues are anoxic. There is usually hemorrhage into the fascial planes of the extremity with a resulting hematoma and pressure on the collateral circulation. Often the collateral circulation



is impossible. The therapy cannot be instituted by him. The limitations of such a man, or the conditions under which he works, had not been taken into consideration in making such a recommendation (2) The institution of surgical procedure in the battalion aid station, where only resuscitation has been practised, would require the revision of the entire system of handling casualties in forward areas. Such might be advocated if there was a large enough number of vascular injuries, but not when these cases constitute less than 1% of the total number of casualties. (3) The time interval between wounding and the institution of surgery has been misunderstood. This interval has been greatly reduced in this war over the last, but still ranges between six and twelve hours, even in emergencies. The average case was usually disposed of surgically under twenty-four hours, and surgical staffs worked long hours to accomplish this result. (4) The preparation of fresh vein grafts was time-consuming and, had frozen grafts been available, another objection would have been removed. However, I do feel, like most of the surgeons in our Army, that this work is a step in the right direction and the method was successfully applied in selected cases.

In lieu of the Blakemore apparatus, glass tubing and plastic tubing was used in a few cases. In all of these non-suture methods of blood-vessel anastomosis, it is essential to use heparin [5, 6] to prevent clotting at the site of repair. The use of heparin in battle casualties is a procedure coupled with considerable risk, as at least one-third of all casualties have multiple wounds and fatal hemorrhage has occurred in a number of heparinized patients.

The treatment used and the results in the cases in this series are shown in the table below:

TABLE II. — TREATMENT OF 837 MAJOR BLOOD-VESSEL INJURIES

<i>Method</i>	<i>Number</i>	<i>Results</i>		<i>% developed gangrene</i>
		<i>Gangrene</i>	<i>Viable</i>	
Ligature	767	386	381	50
Suture	42	23	19	51
Non-suture	28	14	14	50
Blakemore 15		7	8	46
Glass tubing 9		5	4	55
Plastic tubing 4		2	2	50
Total	837	423	414	50.5

From this table it would appear that the Blakemore method of vein graft has a slight advantage, but that on the whole about 50% of the cases developed gangrene no matter what method of treatment was used. This is not in fact true, and it is necessary to break down these figures into the vessels involved, as well as the treatment used, in order to draw any comparison.

Table III shows the results in the vessels treated by simple ligation

aneurysm or false aneurysm. These patients were all treated conservatively in the forward areas and evacuated to the general hospitals in the rear. Operation is seldom undertaken in these cases for six weeks or more, and in the interval the collateral circulation is developed and gangrene of the extremity seldom results.

### CONCLUSIONS

- 1 Vascular injuries constituted less than 1% of the total number of battle casualties in the Third U.S. Army.
- 2 Vascular surgery in battle casualties has made very little progress since the last war [1].
- 3 The method of Arthur Blakemore, *et al.* of arterial repair by vein graft is a step in the right direction, but in general was not found to be practical for routine use in battle casualties with vascular injuries.
- 4 Sympathetic blocks were used as a routine in casualties with vascular injuries, but the results were disappointing.
- 5 The repair of injured arteries produced less gangrenous extremities than ligation of the same group of vessels.
- 6 Continued emphasis should be placed on vascular surgery in order to bring this field abreast of other surgical specialties.

*Footnote*—All of the statistical data in this report were compiled through the cooperation of the Chiefs of Surgery and their staffs of the Evacuation Hospitals, and the Surgical Team Chiefs working in the Field Hospitals of the Third U.S. Army during the European Campaign from August 1944 to May 1945. Because of their tireless efforts, this report has been made possible. Many of the conclusions expressed in this paper are a consensus of the opinions of this splendid group of young surgeons who made such an outstanding record in the care of battle casualties. They treated 99,090 battle casualties in forward hospitals with only 2,574 deaths, or a mortality rate of 2.76%.

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### CONCLUSIONS

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## VASCULAR INJURIES

MAJOR D. L. GRIFFITHS, R.A.M.C.

My observations in the Orthopædic Departments of British Military hospitals are based on a small series of some twenty cases illustrating the effects, acute and chronic, of obstruction of major limb arteries as a result of injuries. They go to support the assertion that a vessel of this nature is a structure whose sacrifice by ligature or excision is apt to have more harmful effects than are generally expected. Even in reputedly 'safe' vessels, like the brachial and superficial femoral, reliance on the collateral circulation will often lead to disappointment. Among my cases, five healthy soldiers sustained grave impairment of the function of the affected limbs after such sacrifice of these two arteries.

In the first of these, ligature of the superficial femoral in the mid-point of Hunter's canal produced gangrene of the foot. In the second, excision of a false aneurysm in the same situation produced a useless and painful paralysed limb, despite the abundant collateral circulation shown in the angiogram. Quadruple ligation of an arteriovenous communication in the lower part of the superficial femoral gave the third of these patients an intermittent claudication which limited his walking to spells of two hundred yards.

My own first arterectomy for intra-mural rupture of the brachial artery below the profunda produced an intractable anæsthesia of the index and middle fingers. A similar result followed the same operation at the same site in a soldier wounded by a bullet, despite the excellent collateral circulation and the proved integrity of the median nerve as seen at a second exploration. A soldier whose brachial artery had been trapped in a fracture of the humerus lost postural sense in his fingers, and I was unable to find a way of alleviating these symptoms in any of these patients.

I therefore plead for a more conservative attitude even to these reputedly safe vessels. Ligature must be regarded as the last resort. Longitudinal wounds of main arteries may safely be sutured, even without heparin. I have also had the happy experience of preserving a common carotid artery by lateral suture after excising a saccular aneurysm.

In completely severed arteries, our hopes are now centred in vein-grafting, with or without cannulation by similar methods to those of Blakemore, but I cannot speak of this technique.

The occurrence of vascular injuries in association with peripheral nerve lesions illustrates two points, of which the first is the frequency with which the injured blood-vessel is overlooked. Thus an angiogram

revealed an internal iliac aneurysm, which was only suspected because a stethoscope was applied to the buttock of a patient with a sciatic paralysis, where it detected a systolic murmur in an unusual site.

The second point is that profound paralysis may be due solely to compression of intact nerves by aneurysms in whose walls they lie. In such cases the prognosis appears to be perhaps unusually good. Three of my own cases illustrate this, the most gratifying being a blind soldier whose profound median palsy from the pressure of a brachial aneurysm recovered so rapidly that he was able to learn Braille-reading sixteen weeks after removal of the aneurysm.

MAY 1945

## EXPERIENCE WITH PERIPHERAL VASCULAR WOUNDS

MAJOR WILSON WEISEL, M.C. U.S. ARMY

This report is based on a series of seventy four patients with arterial lesions caused by shell fragment or gunshot wounds received in battle who were treated in forward Army hospitals during 1944-45. Wounds of vascular structures of the chest and abdomen, as well as peripheral venous injuries, have not been included.

Within a few days after the Normandy invasion we decided to make a concerted effort to return circulation to avascular extremities and to use a standardized aggressive routine for the care of these patients. This conclusion was reached after caring for a large number of patients with major artery wounds in whom clinical gas gangrene had developed despite adequate wound débridement, bacteriostatic drug therapy the extensive use of paravertebral sympathetic blocks, ligation of accompanying veins, and the more favorable prognosis in the ligation of these arteries as predicted by the National Research Council.

Four patients with arterial wounds incurred within ten hours of admission to the hospital were therefore selected for arterial anastomosis by means of the non-suture, vein-graft method using Blakemore vitallium tubes. All four cases had an unsuccessful outcome two patients with severed popliteal arteries died as the result of pulmonary emboli and other extensive wounds, and two patients with severed brachial arteries required secondary amputation due to gangrene. It must be pointed out, however, that heparin was not available or advisable for use in these cases and the other criteria established by Blakemore for success in this procedure were not met.

Following this experience, it was decided to anastomose or suture

lacerations of vessels by a silk technique and these efforts were met by more encouraging results. A large number of patients were seen however, in whom a suture closure or anastomosis of the vessel could not be accomplished because of large defects or gaps in the vessel.

Following reports of the use of glass tubes to bridge arterial defect by Canadian surgeons we began using this method with results which made it seem worth while continuing the procedure. The rationale of the technique was to provide circulation to an avascular limb during the 'precollateral' phase, in the hope that before the tube was blocked by thrombosis, collateral circulation might develop to a degree that viability of the extremity would be insured.

In January 1945, at the suggestion of Colonel J. A. Crisler, Jr., M.C., we began to use a vinethane plastic tubing, developed and supplied by Colonel R. A. Stout, D.C., to bridge arterial defects, and this proved a valuable adjunct in some cases. The advantages which the plastic tubing possessed over the glass tubing were (1) A thinner wall (2) It was malleable when placed in hot water and could therefore be drawn out in length, bent and its ends beveled (3) Most important, it could be cut to a desired length at the operating table.

Along with the anastomotic adjuncts described above we used various methods to allow constant infusion of sodium citrate solution into the proximal arterial segment in three cases, but this did not prove to be a satisfactory procedure in my hands.

From the diagnostic standpoint, it was advisable to suspect vascular involvement with all extremity wounds and to examine the patients with that suspicion in mind. As aids to physical examination, we found the use of the Pachon oscillometer, especially when comparisons between pulsations in the opposite corresponding artery were possible, to be as reliable as arteriograms. The McKesson thermocouple was used to give an objective expression of skin temperatures of the part and this was always found to be lowered in the affected part. The final diagnosis, however, was dependent upon exploration of the vessel in question and this was performed in all the cases herein.

report is based. The cases have been listed by the arteries involved operative procedure and results as follows

TABLE I  
Operation

Artery	Total lesions	Incision	Ligation	Anastomosis				Removal thrombus	Amputation	Result	
				Inter-adjunct	Suture lacerations	Primary strip-ping				Death	Good
Common carotid	4		1		3					1	9
Vertebral	1		1 (a)								1
Sub-clavian	2	2			2						2
Axillary	2				2						2
Brachial	8	2								1	1
			2							1	1
				3					2		1
Femoral	19	4					1		1		3
			5						4		1
				5					2		3
					4				1		3
							1				1
Popliteal	31	5							1		4
			5						2	1 (b)	1
				10					3	2	5
					9				2		7
						2					2
							2				2
Post tibial and Ant tibial and or peroneal	7		7						2	1	4 (c)
Total	74	13	19	18	18	2	4		20	7	48

(a) Bleeding controlled by fibrin foam.

(b) Patient included in amputation series.

(c) This includes one patient who had clinical gas gangrene on admission.

The cases listed as good results were those evacuated from the army area with a viable part and this classification has been confirmed by follow up cards or letters in thirty instances. It should be pointed out, however that many of these patients have required further major surgery because of open wounds nerve and bone damage and those with femoral and popliteal injuries will undoubtedly have signs and symptoms of circulatory inadequacy. The amputations include those patients who, on evacuation, were considered likely to lose any portion of an extremity as well as those amputated in the army area or elsewhere.

Among the seven patients that died were two who succumbed to associated abdominal and chest wounds two of anuria, two of pulmonary emboli and associated wounds, and one of undetermined causes. All of these patients had extensive multiple wounds.

To complete the breakdown of these cases, a summary of those in which an anastomosing adjunct was used is presented, with the results.



were carried out Vascular exercises of active (Buerger's) or passive (tolt-bed) nature were begun within seventy-two hours of the operation and they were continued until evacuation or other therapy was performed When marked edema of the part developed and this was seen most commonly in the calf, lateral, relaxing incisions through the fascia were occasionally necessary In three cases low spinal anesthetics were given to relax spasm in the calf muscles

Heparinization was carried out in three of these patients and all had good results One patient with a popliteal wound treated by intubation with plastic tubing received heparin by intravenous drip. Two patients with laceration of the common carotid artery were given heparin in Pitkin's menstruum

The glass and plastic tubes placed in the arteries were removed after they had thrombosed, usually between the fifth and seventh post-operative day All thrombi were removed at this time and the arterial ends were ligated and pulled together under moderate tension The time of the thrombosis, as determined by inspection of the tube and oscillometric studies, was a variable phenomenon ranging from four hours to six days in this series

The initial oscillometric studies made on these patients showed no oscillations in the wounded part Post-operatively, however, when blood-flow through a major artery had been re-established, there were slight oscillations of two to eight small divisions recorded while the tract was patent These oscillations were always less than those observed in the extremity with normal circulation, but in the patients with successful repairs or anastomosis the oscillations gradually increased

The arteriograms performed on these patients confirmed the clinical impression as to patency or obstruction of the main and collateral arteries There was one miscellaneous procedure, the results of which are of interest It was found that the injection of a 2% solution of methylene blue into a normal artery produced no change in color of the part When this solution was injected into an artery which was obstructed distal to the point of injection, there was an immediate coloring of the skin at the level of injection This color change rapidly extended distally to a point about four inches above the level of skin demarcation.

There has been no attempt to classify these wounds according to the gradation of damage to the collateral circulation that was found at operation because it was our impression that the eventual outcome of the individual case was not related to the extent or destructiveness of the wound It was felt, however, that lacerations of an artery could be given a better prognosis than a complete severance The time interval between wounding and treatment was significant, in that seventy of the wounds were treated within six to twenty-four hours

It was found that there were no good results in wounds more than twenty four hours old.

#### SUMMARY

The experiences of a general surgeon in handling war wounds of seventy four peripheral arteries are briefly presented. These experiences have been similar to those of other surgeons interested in this field. It is discouraging that the results in this series of patients should be so poor but it is felt that results might be improved by the early use of anticoagulant drugs and earlier surgery.



## SECTION IV

### Blood Transfusion

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## BLOOD TRANSFUSION IN THE FIELD ORGANIZATION OF SUPPLIES

BRIGADIER SIR LIONEL WHITBY C.V.O. M.A.

*Consulting Physician in Blood Transfusion and Resuscitation to the Army*

In introducing the subject of Blood Transfusion in the Field, I shall speak of the policy followed by the British Army, compare this with alternative policies, describe the general layout of the Service, refer to one or two of the more interesting pieces of equipment, and indicate, in general some of the limitations of transfusion therapy in the injured.

The British policy decided upon six months before the war is a distinct transfusion service which can produce its own equipment, its own blood substitutes and supplies of stored blood, and which trains and earmarks officers and orderlies especially for the work.

The object was, first, to put all the material and equipment needed into the hands of those who had to use it, without calling upon them to obtain supplies on the spot, and, secondly to ensure that they knew how to use these materials to best advantage.

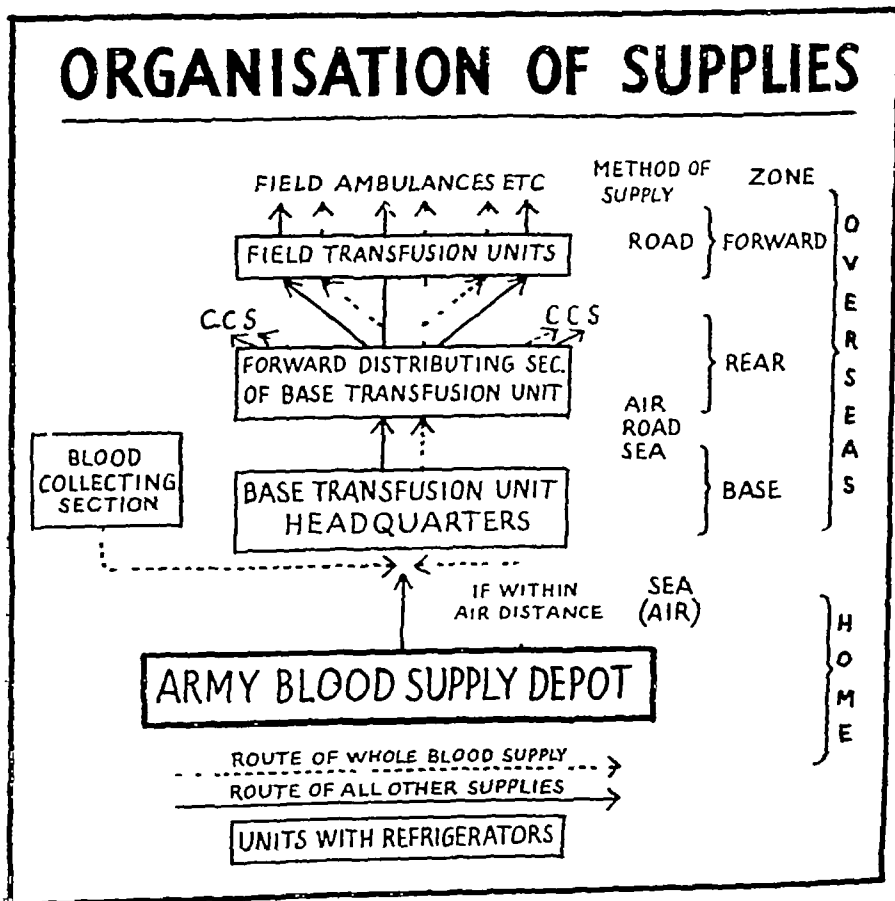
The alternative policy is to rely for blood substitutes upon commercial firms and to distribute through ordinary medical store channels to rely for blood upon what can be obtained on the spot from nursing orderlies or walking wounded having first blood-grouped the whole Army and, finally to rely for efficient transfusion work on the ordinary general duty officer. There can be no doubt of the efficiency and success of the British method. A fine *esprit de corps* has built itself up which has resulted in a high standard of work and the provision or maintenance of supplies, often in circumstances of great difficulty. This is because of the personal interest, as distinct from the impersonal one, of a medical stores or a general duty officer. Surgeons have everywhere acknowledged the value of the full time trained transfusion officer both for saving life and for saving time and fatigue for themselves.

As to blood substitutes the mainstay of the British forces has been plasma or serum in the stable dried form, or in fluid form when bulk and weight have been of first importance. Until recently the Germans relied on a synthetic product called Periston - the main constituent being polyvinylpyrroliden. This has not proved satisfactory according to our own tests on captured material, and according to a number of German medical officers with whom I spoke on a recent tour. Recently we have captured supplies of German dried serum in Italy. Imitation is sincere flattery and moreover the Germans themselves said how

much they had appreciated supplies of our dried plasma captured at Tobruk

As to mass blood-grouping of an Army and the obtaining of blood on the spot the inevitable errors of mass grouping, mainly clerical, are acknowledged by both the United States and the Germans to range from 5 to 10%, whilst the opportunities for using such donors under active battle conditions are negligible. Here again I can quote information given me by German medical officers, who, whilst proudly displaying their equipment, beautiful two-way syringes and every convenience, stated that the opportunities for use had been limited to one, two or three small transfusions in a day. This has been the British experience also.

The general scheme of organization of the Army Blood Transfusion Service is shown in the Diagram which depicts the chain of supply. The most difficult problem has been the delivery of stored blood in good condition to forward areas. All surgeons, though acknowledging the efficiency of plasma or serum, have stated that a proportion of blood is very desirable, more especially for treating abdominal cases for the maintenance of condition during and after operation, for septic cases,



and for those cases of massive hæmorrhage where complete blood volume restoration with plasma, of necessity reduces the oxygen-carrying power below a tolerable level.

Whenever a theatre of war has been within air distance of England, as in 1939-40 supplies have come from here. An air service is essential, and it is highly desirable that this should be especially allotted. In distant theatres of war the blood has been locally produced by the bleeding team section of a base transfusion unit. How successfully this was done and how well the blood was delivered over a supply line of hundreds of miles of desert will be described by Major Barlow (page 186). The essence of success is skilled collection, instant refrigeration and a constant chain of accurate refrigeration particularly under tropical conditions. The units enclosed within squares in the figure are those furnished with mobile refrigerators, which allow these conditions to be achieved for all static positions or reasonable road journeys. During intermediate journeys by air, refrigeration is maintained in insulated boxes.

The small forward field transfusion units have a small but highly trained staff, which carries all equipment and supplies and is drilled to set up its shop in the shortest possible time, with a medical officer capable of inserting needles into collapsed veins, whether it be dark or light, whether standing on his head or his heels or whether drunk or sober! And by reason of their training and wide clinical experience, these officers are capable of making wise judgment on the progress and proper treatment of cases. Systematic teaching by home and base units has disseminated this skill and knowledge widely, and has been one of the most valuable schemes ever instituted by the Army.

Finally, something should be said concerning the success and the limitations of the transfusion service for the treatment of oligæmic shock, the commonest type of shock under war conditions. Transfusion is universally acknowledged as an indispensable provision which has not only saved thousands of lives but also greatly reduced the time of hospitalization. The perfection of the service is worth every penny spent on it and every man or doctor employed.

Yet all with experience will acknowledge that though adequate and prompt transfusion supplies the answer to about 70% of the problems of shock under war conditions, there are still many aspects of this complex subject which are not yet understood. Furthermore, transfusion needs to be skilful and to be given with judgment as to amount and rate, whilst the time at which to evacuate the casualty needs careful choosing. The whole object of the procedure is to bring the case to the surgeon in a fit condition. Particular cases have particular requirements, such as in burns, certain types of wounds, crush injuries and so on.

I emphasize this aspect so that this most valuable life-saving measure may not fall into disrepute by being mechanically applied



to all cases, or by application to unsuitable cases and to cases which are made worse by it. We are in some danger of becoming so transfusion-minded that any but the most lightly wounded might almost be said to be lucky to escape having one. I can only indicate that a transfusion of any kind carries a certain risk, that not every wounded man needs transfusion, that moderate blood loss is easily and naturally recovered from with no more than adequate hydration by the mouth, and that certain conditions, some of them common, are made worse by transfusion. I have in mind fat embolism, pulmonary embolism, pulmonary damage from blast or irritant gases, certain thoracic injuries and many cerebral injuries. I have in mind too that when the symptoms of shock (for of course it is a symptom complex and not an entity) are caused by factors other than oligæmia, then transfusion cannot be expected to be beneficial. But most important perhaps in accounting for our transfusion disappointments and failures is to appreciate what experience and modern study has taught us concerning those who have massive tissue wounds, from which it is believed some contributory toxic factor may arise. In these, the massive tissue wounds, surgery is almost as urgent as blood-volume restoration. Under war conditions, these massive wounds are common, these are some of the roughly 30% of cases in which transfusion is only partially or only temporarily successful, or not sufficiently successful to carry a man through an operation if this be long delayed.

Knowledge concerning these fine details of transfusion work is of prime importance in the field, and hence the application of transfusion needs great judgment such as is only found highly developed in especially trained and experienced officers.

DECEMBER 1943

## BLOOD TRANSFUSION IN THE FIELD. EXPERIENCES IN THE M.E.F.

MAJOR K. G. A. BARLOW, M.B.E., R.A.M.C.

The transfusion service in the M.E.F. has been functioning for over three years, and in that time a most efficient and well co-ordinated service has been built up.

Prior to Alamein the blood transfusion service had to cope with many difficulties, the chief being that of supply to the field units in an Army which swayed to and fro rapidly over a large area. Nevertheless the supply was maintained somehow during those first two and a half years, by road, by hospital train, by sea, and, sometimes, by air.

However, by the time the Alamein battle opened, a high degree of

organization had been developed in preparation for a long and rapid advance, and this proved most adequate throughout the Eighth Army's progress to Tunis. This was primarily due to the use of air transport, and to the formation of a supply unit, which acted as an intermediary between the base unit and the most forward medical units.

To illustrate this, I will explain in detail the layout of the transfusion service in operation for the battle of Mareth, when a detachment of the base unit had been established at Tripoli and where a great weight of stores and equipment had been accumulated from Cairo. It had been found that Cairo was too far away to use directly as a base.

Mareth was an attack on a narrow front against very well prepared German positions. The medical units were fairly compact and the lines of communication not too long.

Briefly two infantry divisions were mainly involved in the frontal attack, with the New Zealand Division making one of their famous outflanking movements to the rear of the German positions. An armoured division was also used to follow up and reinforce the New Zealanders. Both these formations took with them their own field transfusion unit fully equipped and carrying whole blood.

The M.D.S.s of the field ambulances were placed eight miles behind the front line and had two theatres going with one field transfusion unit between them. Here urgent and life-saving operations were done, and the field transfusion unit was particularly busy.

Twenty miles to the rear were two casualty clearing stations, each with four theatres and each with one field transfusion unit, and here much of the resuscitation and surgical work was carried out.

Thirty five miles to the rear were two more casualty clearing stations served by one field transfusion unit.

The supply unit, which had been gradually developed from an ordinary field transfusion unit, had its headquarters and stores on the landing ground used by A.A.T.C. which was the most forward aerodrome to which stores could be taken. Here a large stock, weighing many tons, of all transfusion fluids and apparatus was always held. These included wet and dry plasma, saline, sulphanilamide preparations of various sorts (prepared by the B.T.U. in Cairo) apparatus and whole blood the latter being stored in a mobile refrigerator. The unit was composed of one officer and eight other ranks and possessed five trucks. In addition, another mobile refrigerator was maintained by the supply unit and was termed the advance blood bank, and this was placed as far forward as possible. It was usually sited with, and attached to the most forward motor ambulance convoy check post so that everyone could find it and so that it could move forward easily as soon as an advance commenced. It was in charge of one R.A.M.C. private and one driver.

The supply of blood to this forward refrigerator was maintained by a daily service by truck from the supply unit which also took with it

to all cases, or by application to unsuitable cases and to cases which are made worse by it. We are in some danger of becoming so transfusion-minded that any but the most lightly wounded might almost be said to be lucky to escape having one. I can only indicate that a transfusion of any kind carries a certain risk; that not every wounded man needs transfusion, that moderate blood loss is easily and naturally recovered from with no more than adequate hydration by the mouth, and that certain conditions, some of them common, are made worse by transfusion. I have in mind fat embolism, pulmonary embolism, pulmonary damage from blast or irritant gases, certain thoracic injuries and many cerebral injuries. I have in mind too that when the symptoms of shock (for of course it is a symptom complex and not an entity) are caused by factors other than oligæmia, then transfusion cannot be expected to be beneficial. But most important perhaps in accounting for our transfusion disappointments and failures is to appreciate what experience and modern study has taught us concerning those who have massive tissue wounds, from which it is believed some contributory toxic factor may arise. In these, the massive tissue wounds, surgery is almost as urgent as blood-volume restoration. Under war conditions, these massive wounds are common, these are some of the roughly 30% of cases in which transfusion is only partially or only temporarily successful, or not sufficiently successful to carry a man through an operation if this be long delayed.

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However, by the time the Alamein battle opened, a high degree of

## INTRAVENOUS FLUIDS USED IN A SERIES OF 37 ABDOMINAL CASES

	Blood	Plasma	Glucose saline
Total number of bottles	127	20	473
Average number of bottles per case	3.5	0.54	12.6
No. of cases surviving more than twenty-four hours	= 27		
Average number of bottles of saline in these cases	= 17.6		

## A SERIES OF RECORDED TRANSFUSIONS IN EIGHTH ARMY IN THE DESERT

	Wounded admitted	No. of wounded transfused	Blood per 100 casualties	Plasma per 100 casualties	Total protein per 100 wounded
Alamein	7 393	702 (9.5%)	16	13	29
Alamein to Arghelia	2 926	119 (5%)	13	2	15
Mareth	1 393	200 (14%)	39	18	57
Enfidaville	820	98 (12%)	23	9	32
Total wounded admitted	= 12,532				
Total wounded transfused	= 1 119				
Percentage wounded transfused	= 9.5				
Average number of bottles per 100 casualties	= 30				

The consolidated percentage of wounded transfused is 9.5%

The total protein per 100 casualties varies considerably. The high figure at Mareth was due to the fact that it was a battle against very well-defended positions and in country that afforded no natural cover for the troops. An unduly high proportion of very severe injuries was thus sustained.

The consolidated average of the number of bottles of protein fluids per 100 casualties works out at 30.

This figure and approximately 10% of casualties requiring transfusion are the important ones, and I think the minimum figures likely to be met in fierce fighting, but they form a good basis for the estimation of requirements.

I think the maximum figure would be about 15% requiring transfusion and 45 bottles of protein fluid per 100 casualties. In estimating requirements, however, more has to be provided to allow for wastage.

Cases of abdominal wounds were retained in forward surgical units for seven to ten days after operation and created an immense amount of work for the resuscitation officers.

Apart from the transfusion of these cases before and during operation continuous intravenous glucose saline had to be given for five to seven days after operation. These cases often had to be operated upon before full resuscitation was possible, and demanded a great deal of judgment on the part of the resuscitation officer, especially in those in which an abdominal injury was suspected but not obvious. For example, cases with fairly innocent looking buttock wounds often proved to be perforating injuries of the bladder or rectum and in these cases resuscitation needed much care until the injury had been diagnosed and operated upon.



the shortage of some items was acute. I refer to all sorts of equipment, e.g. corks, blood bottles, needles, screw clips, adaptors and packing cases.

In the desert 15 000 needles alone were unaccounted for and one can understand that a certain amount of misgiving arose in the quartermaster's department, to say nothing of the perturbation in high medical circles. I should like to stress that all used or excess equipment must be returned as soon as practicable to the nearest transfusion unit. If this is not done the resources of the service may be strained to the utmost to keep adequate supplies going.

*Inspection of stores* - Stocks of apparatus and blood transfusion fluids should be frequently inspected. Rubber is apt to perish, bottles get broken, sterilized packets become damaged and stocks of glucose saline and plasma require going over from time to time to ensure that they are still in usable condition. Advice is always given willingly by a field transfusion unit officer and any breakages and deficiencies made good. If a period of hard work is anticipated and if extra equipment can be stored and carried adequate issues can usually be arranged from a transfusion unit.

Small portable boxes containing four wet or two dried plasma complete with giving sets were also supplied to certain R.M.O.s. These were especially useful if evacuation was delayed or if the unit was isolated or cut off.

Blood is used in the main by field transfusion units - the only units possessing refrigerators which are required for the safe storage of blood. On occasion, however, it has been possible to issue blood in small insulated boxes containing bottles of ice. It must be emphasized that blood so issued is only safe for twenty four hours after packing. Before using it, the contents must be carefully inspected regarding its fitness for use. This, of course, holds whenever blood is being used even when it is being taken out of a refrigerator. Appearance of cells and plasma is important as well as the age of the blood.

*Unit resuscitation officers* - The importance that each field unit should possess a trained resuscitation officer should need no emphasis. Skilled resuscitation is all important if a unit is going to save life, if it is going to evacuate its cases with the minimum of delay and if its cases are going to reach the surgeons in good time and in good condition.

The intravenous requirements of intra-abdominal wounds, of chests, of burns, and of head wounds often require the most careful consideration, and their progress needs constant supervision and assessment. While abdominal wounds and severe multiple lacerations and fractures often require many pints of protein fluids, chest, head and infected wounds may only require comparatively small amounts administered slowly and with due care. The early rapid administration of several pints of blood and plasma can well save the life of a man with two

fractured femurs, but the same treatment given to a man with infection of a severe untreated wound may kill him, even though the two cases may exhibit on superficial examination a comparable degree of shock.

*Evacuation* - The early evacuation of casualties by forward medical units needs no emphasis. But from the resuscitation point of view one fact may be mentioned. It is usually better to administer blood or plasma to a case and evacuate with a travelling transfusion before full resuscitation has been attained, than to keep him longer and to try to restore the circulation fully. Otherwise the forward medical units may be overcrowded and it will certainly mean delay in adequate surgical treatment for the case, with the possibility of infection and consequent deterioration in condition. It is often necessary for surgical treatment to be undertaken in a bad case before full resuscitation is provided owing to the toxic factor involved.

In the M.E.F. it was the policy of the service to provide a free supply of blood as far forward as possible, although considerable difficulty often beset us on the supply lines. The surgical units must have blood, and if units further forward can be supplied with it so much the better. However, all units carry plasma and it is for them to see that their stocks are adequate and that they know where to get hold of replenishments easily and at short notice. In this way they should be well provided for, and can so resuscitate and evacuate their casualties safely and satisfactorily.

*Use of B.T. needle.* - I should like to put in a plea for the use of a blood transfusion needle rather than the use of a cannula for transfusion. A needle is very much easier and quicker to put in the vein, and fortunately it is found that the veins of a man in dire need of urgent resuscitation are almost always quite well filled, and easy to enter with a needle. The technique of venepuncture with a B.T. needle is not as simple as it looks, but it can easily be practised with a piece of fine bore rubber tubing covered with cellophane or paper and suitably fixed. A little practice in this vital procedure is well repaid.

It must be remembered that the further down the line a casualty gets the more intravenous therapy he is likely to receive in the form of blood, saline or sulphonamide. In general hospitals one often found cases which had had several transfusions by means of cannulae on their way back, and had no suitable veins left. If a cannula has to be used, it is better to make use of a vein on the forearm or ankle than to use the more obvious ones in the antecubital fossa.

Prolonged and slow transfusions can be given with a needle, provided the latter is well placed up the lumen of the vein and secured firmly in position with elastoplast.

The use of a splint is almost essential if, as usually happens, the transfusion cannot be continually supervised. If a splint is used for any length of time the elbow should be flexed slightly using a splint

of Cramer's wire and P O P slab. If it can be arranged, it is much more comfortable for the patient to have his forearm in pronation rather than in full supination.

*Sternal transfusions* - The administration of protein fluid into the bone marrow of the sternum is worth remembering in a case in which no veins are available, e.g. bad burns or in multiple fractures, or in a particularly restless case. Blood will run in only slowly but plasma can be given quite fast. The method is not one of choice, but might on occasion prove useful. It is described by Tocantins and O'Neill in *Surgery Gynecology and Obstetrics* September, 1941 73 281. An ordinary blood transfusion needle can be adapted for this purpose with a little ingenuity.

*Taking blood locally* - Much has been said on the question of forward medical units using walking wounded as donors. Although it has been done with good effect on numerous occasions I do not think it is entirely satisfactory. There is usually little time to group and bleed donors if the unit is busy. The careful grouping of the donors requires an officer experienced in this procedure, and also needs good high titre grouping serum. The possibility must be borne in mind of the grouping serum having gone off and of the citrate being contaminated and unfit for use if it has been stored too long.

*Sicily* - In the seaborne invasion of Sicily each man in the smaller medical units carried a bottle of plasma and a giving set in his pack, each in a waterproof container. Thus the unit was certain to have a considerable amount of plasma available, even if its equipment got lost or damaged and so it was able to commence resuscitation measures as soon as it got ashore.

One field transfusion unit which went in very early carried 80 bottles of blood in insulated boxes which were slung on a stretcher carried by four orderlies in addition to their packs and equipment. The officer i/c wrote to me it was beastly heavy going from the landing craft and we almost wished we hadn't brought the stuff. However we were transfusing with blood within an hour of getting ashore and the results well justified our efforts.



## BLOOD TRANSFUSION IN THE FIELD

SURGEON LIEUTENANT-COMMANDER F P ELLIS

*Royal Naval Hospital, Haslar, Gosport*

The provision of facilities for the transfusion of protein fluids such as blood, plasma or serum, in H M ships, presents certain difficulties which are peculiar to naval warfare

## TABLE I - THE TRANSFUSION PROBLEM AT SEA

- (1) Warships may be congregated in fleets at one time, and scattered all over the world shortly afterwards. Stores of transfusion fluids must be equally distributed according to scale between all ships, as it is not known when and where they may have to go into action. Supplies must, therefore, be large.
- (2) Medical Officers are also widely distributed to the different ships. Rarely in sufficient numbers to allow for the provision of separate transfusion teams. May frequently be short of practical experience of the transfusion methods.
- (3) High incidence of burns causes demand for serum. Considerable incidence of blast injuries, nitrous fume and carbon monoxide poisoning provide traps if transfusion is too hasty.
- (4) The practical difficulties, when short-handed, especially in small ships, are always considerable.

The problem of supply is complicated by the fact that all warships must be complete operative units, and although employed in non-operational spheres for much of their time they must be fully prepared for front line action with a minimum of delay, this means that such resuscitation facilities as are considered necessary must be always available in all ships on active service within the limits of supply. This provides the first point of contrast with the situation in the Army, where the administrative authorities have some premise as to where the battle is likely to take place and are able to concentrate their supplies in advance units near to the forward areas.

The distribution of medical officers has also to be equally carried out throughout the fleets and the allocation of one, two or three medical officers to single ships is inadequate to allow for the special training and occupation of some of them in the special duties of transfusion or resuscitation officer.

There can be no organization in naval warfare to compare with the mobile teams of resuscitation experts who are now carrying out the early transfusion of battle casualties ashore, and whose records have added so greatly to our knowledge of the practical treatment of shock in this war.

As a result practical experience has mainly been gained in base hospitals and hospital ships where, too frequently, cases have not been received before a lapse of eight to twenty hours after wounding, and the

opportunity for observing the acute phases of shock has not always occurred

The clinical problem has also been modified by several factors. The high incidence of burns in many actions has resulted in heavy demands on plasma or serum. Medical officers must be very wary lest they transfuse cases with blast injuries to the lungs, which are to be anticipated in bomb shell mine or torpedo explosions occurring in the confined and crowded spaces of a ship. In the presence of fire, nitrous fume or carbon monoxide poisoning may occur and are additional contra indications to transfusion.

Furthermore, the practical difficulty of performing venepuncture or venesection in a vibrating ship proceeding at full speed with the turmoil of damage repair or possibly of a running action is obviously considerable - especially if the operator has not had recent practice. The possibility of transfusion by sternal puncture has been suggested for such an occasion. We have no practical experience of it and apart from possible risks attendant upon such a procedure in unskilled hands, one is doubtful if it would prove of practical value. It would be interesting to hear the experiences of someone who had carried out transfusions by the method.

The emergencies at sea will fall into three main categories: the first when the casualties are so numerous that the provision of adequate first aid and dressing of wounds together will more than tax the full facilities available (H.M.S. *Illustrious* heavily bombed off Malta); the second when, following essential first aid - such as immobilization of fractures and securing adequate hæmostasis - has been carried out, transfusion of the most severely wounded may be attempted. Lastly with the occurrence of only two or three casualties, due possibly to isolated accidents or bomb splinters, it should be practicable to exhibit the full care and attention which adequate resuscitation demands.

#### BLOOD AND BLOOD SUBSTITUTES

1 *Serum and plasma* - For use in ships the choice of a protein fluid falls upon dried plasma or serum. These blood substitutes can easily be preserved, do not require careful refrigeration and are apparently unaltered by constant vibration. They achieve an admirable therapeutic effect in the treatment of burn shock and the initial treatment of oligæmic shock, and the incidence of adverse reactions is low. We know dried serum can be safely used after preservation for three years - how long this period of safety extends beyond that time we do not know but it may well be considerable. The double bulk of carrying bottles of dried serum and bottles of *saline* for their reconstitution, when this is necessary lays a heavy strain upon transport.

2 *Blood*. - The clinical indications for the use of whole blood at sea are to be anticipated under the following circumstances. First, after two to three bottles of plasma have been administered and recovery has not

they were burnt. Two of them, with gross hæmoconcentration, died. The improvement in the other cases was remarkable.

Clegg and Wolfe have described how they treated 16 of the most desperately burnt cases in the hospital ship 'Maine,' which was lying in the harbour at this time. Their cases were all severe, 7 died, and plasma was considered to be the great factor in saving the majority of the survivors.

Protein fluids are essential for these cases, and it is likely that, as the standard method of treatment is to change from the principle of applying a coagulating application to extensive burnt surfaces to that of using non-occlusive creams, the demands for such fluids may well outstrip the sources of supply at times.

The great value of fresh blood was observed in the treatment of the sometimes surprisingly severe anæmia which may occur seven to ten days after burning.

#### SUMMARY

(1) Reconstituted plasma or serum is the protein fluid of choice for resuscitation in ships.

(2) If blood is strongly indicated it should be freshly drawn from reliable donors.

(3) Ready availability of transfusion facilities must not be allowed to dazzle clinicians and prevent their carrying out the essential first-aid which should always precede the tackling of transfusion problems.

(4) Transfusion at the earliest possible time after wounding is essential if wounded are to survive severe oligæmic shock. A large miscellaneous group of severely wounded cases were received within ten hours after wounding, the immediate mortality was not greatly affected by the lack of elaborate transfusion arrangements.

(5) Serum transfusion of burns will often achieve admirable therapeutic results even if initiated, by force of circumstances, after a delay of twenty-four to thirty-six hours after wounding.

(6) The surgeon should always see the case prior to resuscitation if possible. For the desperate cases, surgery is nearly always essential, but should be minimal, and resuscitation should be continued after operation.

(7) Great care should be exercised in transfusion of cases with injury to the lungs or chest wall.

(8) If tanning of burns should be preceded by the use of coagulating applications, the demand for plasma or plasma greatly increased.

## BLOOD TRANSFUSION SERVICE FORWARD UNITS IN NORTH AFRICA

MAJOR GEORGE LUMB, R.A.M.C.

Resuscitation in the field under active service conditions is performed very largely by field transfusion units. These are small units consisting of an officer, two nursing orderlies and a driver. The following account is based on the experiences with such a unit during the North African campaign in Algeria and Tunisia.

*Siting*—The siting necessary for forward transfusion work is of interest. Except in special circumstances, such as assault or parachute landings, it is usually of no value for a regimental medical officer to attempt any advanced resuscitation. The field ambulance, either in its advanced or main dressing station, the casualty clearing station and the field dressing station are equipped to perform their own transfusions, but during an action it is usual to place a field transfusion unit with one of these units if numbers of acute casualties are expected. One can therefore study the best position for full resuscitation by observing the ideal siting of a field transfusion unit.

The important factor in deciding where to place the transfusion team is not one of distance but of time. The best time to see a case is between two and three hours after the man has been hit. The site, therefore, may well vary from one to several miles from the fighting, according to the terrain of the battlefield.

It is a point worthy of note that at this time interval most of the effects of primary shock will have passed off and the problem of diagnosing secondary shock will be very much simplified.

The ideal combination for forward operating consists of two field surgical units working with one field transfusion unit. The advisability of divorcing the field transfusion unit from field surgical units and placing it further forward in order that resuscitation may be started earlier and continued *en route* to the surgeon has often been argued. This is a bad practice as it is undoubtedly true that a peak point in the recovery is reached, which it is impossible to regain once it has passed. If this point should be reached before the case has got to the surgeon—as may easily occur if the two units are not together—much damage may be done. Separation of the units will involve performing a transfusion while the patient is in transit and the ease with which transfusions can be carried out in an ambulance depends very largely on the terrain. In the Desert Campaign they were performed with some success, whereas in Tunisia it was almost impossible to keep an

intravenous drip going whilst the ambulance car jolted over the rough mountain tracks

*Equipment* – The equipment of the transfusion unit is good and adequate. A three-ton lorry fitted with a refrigerator driven by a small petrol motor is provided, and this excellent vehicle provides the home and storehouse for the unit. An undoubted deficiency in equipment is a tent or penthouse for use either as sleeping accommodation, or as a place in which to work. Most units, however, speedily correct this, once they are overseas, either by means of judicious friendship with some amiable quartermaster or by turning a blind eye to the acquisitive faculties of the orderlies!

*Functions.* – The chief functions of a transfusion unit in the field are sorting, resuscitation, and preparation of operation lists for the surgeon. It is valuable also for the field transfusion unit officer to be in charge of the post-operative ward, where he can supervise intravenous therapy and continuous gastric suction and lavage. The importance of the same field surgical units and field transfusion unit working together over long periods is clear. Each one has confidence in the other, an essential feature for an efficient team. As one of the chief preliminaries to adequate resuscitation the importance of making the patient comfortable despite poor working conditions cannot be overstressed. It is interesting to note how efficient at achieving this the R.A.M.C. orderlies become.

With regard to transfusions, there have been long arguments as to the relative quantities of blood and plasma which should be used for ideal resuscitation. As a personal experience it was found that for most injuries other than penetrating wounds of the abdomen, a ratio of 3 pints of plasma to 1 pint of blood was usually satisfactory, whilst in abdominal injuries more blood was required, most frequently in the ratio of one to one.

Replenishment of stores is done by the base transfusion unit.

#### SUMMARY

In conclusion three salient points may be repeated

- (1) The importance of siting the resuscitation unit at a range of two to three hours from the place of injury
- (2) The importance of close co-operation between surgeons and transfusion teams
- (3) The duties of the field transfusion unit should be comprehensive of all aspects of resuscitation and not simply confined to transfusion.

APRIL 1945

## BLOOD TRANSFUSION SERVICE SUPPLY PROBLEMS IN AN OVERSEAS BASE

BRIGADIER J. S. K. BOYD O.B.E., M.B.E.

*Headquarters, Scottish Command*

The organization and administration of the blood transfusion services in an overseas base is carried out by the base transfusion unit (B T U). There is one such unit in each theatre of war, with a sliding scale of personnel and transport to enable its size to be adjusted to that of the force which it is serving.

The B T U occupies a place midway between the army blood supply depot (A.B.S.D.) at home and the field transfusion units (F T U.s) and transfusion departments of general hospitals and other smaller medical units in the field. Its main functions are to budget for and procure or manufacture the necessary supplies of transfusion and infusion fluids and apparatus, to maintain adequate stores of these items and to distribute them to the consumer units.

The items handled by a B T U fall into two distinct categories, namely articles such as plasma, crystalloid solutions and apparatus, which are relatively non-perishable, and blood, which is essentially perishable and calls for special arrangements.

Most of the non-perishable articles are obtained through the same channels as other medical stores, and differ only in being supplied by A.B.S.D. The policy adopted in 21 Army Group was to take across as much as possible as soon as possible, to build up a substantial reserve, and to maintain this by monthly demands. The target reserves of plasma and saline were 20 000 and 30 000 bottles respectively.

Plasma normally comes from A.B.S.D. but in M.E.F., owing to sudden demands and shipping delays, it was found necessary to produce it locally on one occasion (for the invasion of Sicily). Provision exists in the war establishment of a B T U for a plasma making team, but this should be required only in very exceptional circumstances.

The manufacture of crystalloid solutions is one of the commitments of the B T U and is undertaken as soon as the unit is settled down in suitable premises, with adequate water and electricity supply, work rooms, etc. In the preliminary stages supplies must come from the A.B.S.D.

The reconditioning of giving sets is also undertaken by the B T U when it is settled down. Forty workers, half of whom must be skilled, can turn out four hundred sets a day. Very careful supervision, and expert inspection of finished work, is essential.

Whole blood presents special problems of supply if waste is to be

avoided. It must be kept at a low temperature (2° to 6° C.) and must be used within twenty-one days of being drawn

It is important to estimate requirements as accurately as possible. The original forecast that about 10% of all wounded would require transfusion proved remarkably accurate. In the M E F this was almost exactly the figure and Table I gives the equivalent figures for 21 Army Group

TABLE I - ANALYSIS OF TRANSFUSIONS

## 1. - FORWARD UNITS

	% <i>Transfused</i>	<i>Bottles per case</i>		<i>Total blood and plasma per case</i>	<i>Ratio of blood to plasma</i>
		<i>Blood</i>	<i>Plasma</i>		
D-Day to Sept 30	12	2 6	1 5	4 1	1/0 6
Oct. 1 to Dec 31	11 5	2 1	1 5	3 6	1/0 7

## 2. - GENERAL HOSPITALS

D-Day to Sept. 30	9 2	1 2	1 5	2 7	1/1 3
Oct 1 to Dec 31	7 5	1 3	0 7	2 0	1/0 5

For practical purposes it is convenient to budget in terms of bottles required per 100 wounded. Table II shows the actual consumption for different periods in the M E and European campaigns

TABLE II - PROTEIN FLUIDS PER 100 WOUNDED

(Number of bottles)

		<i>Blood</i>	<i>Plasma</i>	<i>Total</i>
M E F	Nov 1940-Sept 1941	2	15	17
	Oct 1941-March 1942	18	15	33
	Apr 1942-Sept 1942	23	45	68
	Oct 1942-March 1943	50	50	100
	Apr 1943-Aug 1943	48	37	85
21 A Gp.	D-Day-Sept 30	51	45	96
	Oct 1-Dec 31	43	39	82

It amounts roughly to 50 bottles of blood per 100 wounded and this was the figure used throughout the European campaign. It is much more difficult to forecast the number of wounded. During periods of sustained fighting, as in the early days in Normandy, casualties were relatively constant and turnover rapid. Demands varied from 200 to 600 bottles per day, and with a regular daily consignment there was no difficulty in avoiding wastage. In the later stages, with alternating quiet periods and battles, the position was more difficult, as plans were often changed at short notice. The general principle adopted was to avoid sudden large demands and to build up a reserve for some days in advance, so that when an offensive started ample stocks were in hand, and an enhanced daily supply arriving.

The source of supply of whole blood turns on the relative positions of A.B.S.D. and B.T.U. In M.E.F. it was necessary for the B.T.U. to take blood locally, and a large 'blood-taking' department was established. In 21 Army Group all blood came from A.B.S.D. except

during a few periods of prolonged bad weather, when the bleeding of army donors had to be undertaken. All F T U.s in the assault group landed with supplies of blood in their refrigerators, and until air-strips were functioning on the other side, 400 bottles of blood (1 ton) in special insulated boxes were ferried over daily by a naval despatch boat. As soon as possible, air transport was instituted and except in bad flying conditions remained the transport of choice.

Important points in the smooth functioning of this system are -

- 1 Immediate communication with A.B.S.D - preferably by telephone through the War Office.
- 2 Permanent location of a collecting party with a refrigerator truck on the air field otherwise consignments are constantly going astray

Efficient distribution from B T U to forward units is of the greatest importance. This became very obvious in M E F where an F T U was misappropriated and given this special task. Included in the modern B T U are forward distribution sections, known as advanced blood banks (A.B.B.s) one of which is posted to each army and allocates a section, complete with refrigerator truck, to each corps. The chain of delivery is from the headquarters of the B T U to the headquarters of the A.B.B. thence to the section with each corps, thence to the consuming units.

The slogan of the distribution system is delivery on the doorstep for experience has shown that anything short of this, such as getting F T U.s to collect blood from the A.B.B. invariably breaks down during a rush period. It is important to keep the same section permanently attached to one corps, as the men get to know the units they have to visit, and smooth working is ensured.

An advantage of this delivery system is that it works in reverse, and collects and returns empties for re filling and used giving sets for re conditioning. Blood alone is on the free list. Everything else is supplied only in exchange for its used equivalent, unless it be an initial supply or a bona fide emergency demand.

The professional activities of this versatile unit are manifold, and include maintaining a constant check on the quality and more especially the sterility of the potentially dangerous items which it issues. It undertakes the training of officers and other ranks in transfusion technique, and its experienced officers are constantly in request to act as advisers both to senior officers in matters of policy and to transfusion officers in everything pertaining to their speciality.

The base transfusion unit is a product of the war. Its origin was modest, its evolution gradual but it is beyond doubt that it is now established as one of the key units in the modern set up of the medical services in the field.



APRIL 1945

## BLOOD TRANSFUSION SERVICE ORGANIZATION AND RESULTS IN 21 ARMY GROUP

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Since last speaking to this Conference in 1943 [see page 183] the organization of the Army Transfusion Service has been put to the supreme test, and would appear to have withstood the strain I attribute this mainly to the *esprit de corps* which has been built up in a service which is a distinct department of the Army Medical Services, and which has thereby provided the personal touch. Only thus have we been able to maintain supplies, whatever the obstruction and whatever the weather. Only thus have we been able to provide officers with sufficient skill and knowledge to gain the trust of surgeons for selecting the operation list and for taking the responsibility for post-operative care. This, in its turn, has freed the surgeon of much worry, has saved his time and enabled him to concentrate on his own work. We have also reaped handsome dividends from our School of Instruction, which has been in continuous operation since 1940. Here we have disseminated knowledge to over 2,000 of our officers and men, and we have had the chance of making many friendships with the 200 American officers who have come and sat at our feet. Our organization differs from that of all other armies, in that we have an army blood supply depot in England, which is the basis of supply, and which is independent of commercial firms, we have a base transfusion unit in every theatre of operations, which is mainly concerned with distribution, whilst field transfusion units in forward areas do the practical work in conjunction with field surgical units.

To date, the B L A in Europe have received some 97,000 pints of blood, 57,000 pints of fluid plasma, 45,000 pints of dried plasma and 133,000 pints of glucose-saline. The main worry has been the delivery of blood in good condition and of guaranteed group. In the British Army we have been meticulous about refrigeration from the time of collection to the time of use, and we have made it a rule to test both agglutinogen and agglutinin content of the blood before accepting it as Group O. To these two details I attribute the fact that there has been no suggestion of transfusion disasters, and no report of an incompatible transfusion. It is true that there has arisen a number of cases of unexplained post-operative anuria, but most authorities consider that this may arise irrespective of transfusion. The fundamental pathology is not yet understood, but it seems probable that renal ischaemia

preceding resuscitation may so damage the kidney that it cannot afterwards recover its normal functioning power

The results of this service have been remarkable, when taken in conjunction with the life saving measures which can complete the good work begun by the intelligent application of transfusion, namely prompt and efficient surgery and the control of sepsis with penicillin and sulphonamides. The recovery rate of the wounded has been estimated to be from 80 to 95%. Nevertheless, the running of a transfusion service, and the mass supply of readily infected biological products, have been a tremendous responsibility.

APRIL 1945

## BLOOD TRANSFUSION SERVICE ORGANIZATION AND RESULTS AT A HOME BASE

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*Officer in Charge R.A.F. Mobile Blood Transfusion Team*

My remarks are confined mainly to the experiences of a mobile team during the period June 1944-April, 1945. This R.A.F. team had spent a considerable time prior to D-Day at Nottingham, where it shared the laboratory facilities with the Ministry of Health Regional Transfusion Service, its objects being to collect blood for plasma processing and to render token support in supplying civilian hospitals with fresh blood.

With the advent of active fighting on the Continent, it was considered that this team would be most profitably employed in the North Midland area and that its prime function should be that of blood collection. We were informed that convoys of 200-300 wounded would be arriving in the region at regular intervals - for which we should have to organize a blood supply service. In addition, we were required to co-operate with the Leeds and Sheffield depots in the supply of fresh O.V. blood to the Army Transfusion Service for use in the forward areas.

All bleeding performed in this region was on a mobile basis carried out by the R.A.F. team and a Ministry of Health team of slightly larger composition. Prior to July 1944, the R.A.F. team had an average monthly production of 1 000 units of blood - 450 group O.V. units going to the blood bank and 550 units of other groups to the plasma pool. The extra commitments after D-day called for an increased monthly production of 1 500 units - 1 000 group O.V.s going to the blood bank and 500 of other groups to the plasma pool. This

doubling of the O1V output with only an increase of 50% in our total output was achieved by selective bleeding 1,500 units per month, however, was the maximum our limited laboratory and refrigeration facilities would allow. The Ministry of Health organization similarly increased their output – resulting in a combined monthly yield of about 3,000 bottles.

Our working programme consisted of donors sessions on Tuesdays, Thursdays and Sundays and laboratory procedure on Mondays, Wednesdays and Fridays. To maintain a steady supply of fresh blood and to spread the laboratory duties as evenly as possible, the sessions were planned to produce a guaranteed yield of 125-140 units per session. The problem of obtaining a fixed return from volunteer panels was solved as follows. Donors were of three types –

(1) Civilians enrolled in well-established donor panels recruited by the Ministry of Health and called-up by postcard to suitable centres.

(2) Civilians enrolled in factory panels administered by the factory first-aid officer.

(3) A limited number of Army training depots, ordnance depots and R A F stations – containing a problematical number of ungrouped donors. The R A F stations in this area were largely excluded from the scheme as they are mainly operational.

The Sunday session was devoted entirely to bleeding known O1V donors from the civilian panels, a variety of premises being used for this purpose. The donors were called by postcard on the assumption that seven people per  $\frac{1}{2}$  hour, or twenty-eight per hour, would attend. The call-up was based on the average percentage attendance of sessions held previously, and showed remarkable variations in different areas. Our most responsive locality yielded a steady return of 95% of donors called and the least responsive 33%. On this basis, the first locality would yield 140 units of blood for 150 postcards and the second 140 for 420 cards. By this method, although the card numbers fluctuated, the blood returns remained static and numerous sessions were carried out with a fixed return of 130-140 units. The  $\frac{1}{2}$ -hourly appointments system has proved of untold value, as it has banished queueing and ensured the re-attendance of donors on future occasions. Postcards and donor lists were prepared before D-day and, when the time came to use them, only a date stamp was required.

The Sunday yield of O1V (Universal) blood was group-checked and Kahn-tested on Monday morning and collected by the Army Transfusion Service on Monday afternoon. Thus the blood was only 24 hours old when it left us – ensuring a reasonably lengthy period of usefulness on the Continent.

The Tuesday session was devoted to visits to factories, where a fixed percentage of O1V s was collected to support the local blood bank. The Thursday session was confined to service units – O1V s going to the blood bank and the others to the plasma pool.

During this period, I have been impressed by the enthusiasm of both civilian and service donors, who showed remarkable understanding of the urgent need for blood.

Various propaganda methods are used in recruiting new donors - official M.O.I. posters and booklets proving less successful amongst service personnel than amongst civilians. Service units were encouraged under official guidance to produce their own propaganda - with remarkable results in some cases.

These remarks will give you some idea of the planning required to ensure an adequate, but not unwieldy, blood bank and here I would like to pay tribute to the excellent performance of the W.A.A.F. nursing orderlies, who with only three days per week at their disposal for laboratory work not only maintained all the blood taking equipment, performed the group-checking and Kahn testing and syphoning and filtration of the plasma but also found time to make up and sterilize countless blood-giving sets for use in hospitals and R.A.F. stations. Some relief from the rather monotonous tasks associated with a transfusion laboratory was afforded by the interchanging of their duties.

*Local blood distribution.* - We were fortunate over the problem of distribution in that we had relatively short and fixed lines of communication - and the blood stocks could therefore be despatched without refrigeration *en route*. All the key hospitals receiving wounded were within 35 miles of Nottingham. These hospitals, comprising E.M.S., Army R.A.F. and American Army units, were all supplied with a fixed quota in accordance with their needs at weekly intervals. The van delivering these supplies also collected any time-expired bottles for plasma processing. A 24 hour per day emergency service was instituted for hospitals having exhausted their quota and needing further supplies, blood being sent by transport, train or bus according to distance and urgency of the need.

The hospitals played their part in helping us to organize a smooth distribution service by giving us ample warning of the probable arrival of convoys - ordering early to avoid disappointment. The greatest number of O.I.V.s held for local issue at any one period was 300 and the smallest 11, but we never had an overdraft!

As the home bomber stations contained no facilities for keeping fresh blood, they were issued with dried plasma, distilled water and giving sets to meet the possible casualties resulting from the increased offensive of the latter part of 1944. In May 1944 all operational bomber stations in this region were issued with packs containing 6 plasma 6 distilled water and 6 blood-giving sets, and a further reserve was placed at each of the adjacent bomber group headquarters. These supplies came from the stocks of dried plasma we had built up during the earlier part of the year.

The key hospitals in the area also had their stocks of dried plasma,

distilled water and sets increased to a maximum holding of 200 units during the early summer, the minor hospitals receiving supplies on a reduced scale.

*Results achieved by the Blood Supply Service* - Our follow-ups have been in the nature of routine enquiries to the surgical personnel of the various hospitals concerned in the North Midland Region. Both civilian and service surgeons who have been contacted in this area are all agreed on one point - all have been surprised by the excellent condition of the wounded reaching this region. Many of the cases have had considerable attenuation, of course, before reaching the Midlands. This happy state of affairs is a great tribute to the work of the Army Transfusion Service and to the surgical teams operating in the forward areas. The blood used in this area was mainly for cases whose condition had deteriorated in transit and casualties undergoing further major operations in the hands of specialist surgical teams, such as thoracic and orthopaedic units. All transfusions were performed with a minimal reaction rate and only four cases were referred to our laboratory for further investigation. These cases were all similar - having received massive primary transfusions of OIV blood some seven to ten days previously and now requiring further major operations attended by secondary transfusions. The hospitals' difficulty arose in cross-matching, and this was probably due to a combination of factors (a high titre, side reaction due to chemotherapy, and sepsis). We overcame this problem by putting up samples of the patient's sera against batches of from 40 to 50 units from the blood bank. In this way it was always possible to find two or three bottles in which no agglutination occurred (after two hours' incubation at 37°). Follow-up of these cases showed that the secondary transfusions all proceeded smoothly and without incident.

As regards the transfusion of aircrew casualties on bomber stations, our returns indicate that no bomber group used more than its quota of six sets per station during the six months July-September 1944. The station medical officers, however, have appreciated the value of plasma in the occasional severe injuries they have been called upon to treat from time to time, and many have fitted brackets to their ambulances to hold M R C type bottles for transfusion in transit. The R A F. hospital receiving bomber casualties in this area has commented favourably upon the condition of casualties arriving with a plasma drip in action - particularly in burn cases.

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### Neuropsychiatry

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# ORGANIZATION AND WORK OF THE WAR OFFICE SELECTION BOARDS

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*History of officer selection.* — In the early part of the war it became clear that some method other than mere interviewing would be required to select candidates for commissions. This opinion was reached for various reasons —

(1) In contrast to previous wars, the Army had very little experience of contact with the enemy and the test of battle was, for the most part, not available for the selection of good officer material

(2) It was known that the German Army from about 1926, had used scientific methods of selection for officers and specialists. Some account of these methods had been given by military attachés and by Germans themselves. There were a number of contributions to scientific journals describing the basis of their officer selection testing

(3) Selection testing for O.R.s in the British Army had already proceeded to the point where it became logical to extend this selection to the point at which it would be most important, namely in the choice of those who should hold commissioned rank.

At first the experiments which were carried out in Edinburgh were on an unofficial basis. Several of the German tests were used plus an intelligence test and a psychiatric interview. The German tests came out of this investigation without much being able to be said in their favour, and attention was concentrated on the use of the psychiatric interview and intelligence tests. It was, however clear from the beginning that an assessment of personality must be made on the broadest possible basis and that psychiatric interviews plus written psychological tests would never be enough. For this reason, as soon as the experiments left the unofficial and informal stage, military officers were brought in.

An experimental unit was started in January 1942 and more intensive investigation was carried on, with the result that several other items were included. By March 1942 a practical scheme for officer selection testing had been worked out to the satisfaction of the War Office and other units were started up throughout the country so that, for some months past, all candidates for commissions appeared before one of these units.

*Constitution of the W.O.S.B.s* — That is the background of what have become widely known throughout the Army as War Office Selection Boards. The personnel constituting the Board are as follows —



- 1 President (colonel)
- 2 Deputy president (lieutenant-colonel)
- 3 Senior military testing officer (major)
- 4 Two other military testing officers (captains)
- 5 Two psychiatrists – one a major specialist and the other a graded psychiatrist
- 6 A psychologist
- 7 Technical officers from various arms

They are assisted by O R personnel such as clerks, orderlies, etc., and by two sergeant testers from the staff of the directorate for selection of personnel. Each Board has an output of about 120 candidates per week. They occupy premises which include testing rooms, interviewing rooms, living accommodation shared by officers and candidates and sufficient ground near the Board for outdoor testing. The candidates are accommodated as officers, discipline is relaxed during the period of testing and there is an atmosphere of comradeship and goodwill.

In order to ensure that differences of rank do not obtrude, the candidates wear arm bands with numbers and are known throughout the period of testing by their numbers. The period of testing varies somewhat according to the accommodation and programme adopted by individual Boards. It is never less than forty-eight hours or more than seventy-two hours.

*Tests* – The written tests consist of –

*Intelligence tests*, these are three in number

- A The matrix test
- B The verbal intelligence test (S P 15)
- C The reasoning test (S P 45)

With this battery of tests we are able to give a very reliable intelligence rating and we are also able to assess the particular talents which go to make up the candidate's level of intelligence. For example, a candidate may score high in the verbal intelligence test and low in the matrix test, which shows that he has a less practical turn of mind than a man who scores high in the matrix test and low in the verbal test.

By testing large numbers of O C T U cadets and serving officers, norms have been derived which show that to make a tolerable officer, intelligence must be at least as high as that of the average private soldier. This level is taken as the lowest acceptable intelligence grading for officers and candidates are rejected who have an intelligence rating below this minimum.

*Questionnaires* – Two questionnaires are completed by the candidate.

The first is a factual record of his history for use of the interviewers including the president and the psychiatrist and the second questionnaire is for the use of the psychiatrist only. This second questionnaire covers the family history and also aims at discovering those candidates who have chronic complaints, possibly of a neurotic kind, which fall

outside the scope of medical classification. The idea here is to obtain some measure of the day-to-day efficiency of the individual so far as it is determined by the presence or absence of minor complaints. It is also an aid in picking out those cases whom the psychiatrist considers require special investigation.

*The word association test* - A series of 50 words are exposed on cards for fifteen seconds each during which time the candidates have to write down their spontaneous responses as fully as possible. This test is derived from Jung's word association test. The selected words in this case concentrate on aspects of the personality which have been found to be important in the selection of officers. For example, there is in the series a group of words which have two categories of meaning. They can be used in a military sense or in a social or industrial sense. From the responses to these words a good deal of information is obtained about the prevailing trends in the mind of the candidate, and an opinion can be formed as to whether he is directed in a healthy way towards his present task or is preoccupied with purely personal matters. Certain other words evoke reactions in insecure anxious individuals with deep personal problems. Very often a response to these particular words is a blank which suggests such a degree of preoccupation with personal difficulties that the need to interview the candidate carefully is at once suggested.

*The thematic apperception test*. - These pictures are derived from part of a test devised by Murray of Harvard and described by him in his book *Explorations in Personality*. They are vague rather sombre, and dramatic pictures portraying ambiguous social situations. The stories the candidate writes about them usually involve his own dominant fantasy trends.

All the information gathered by the questionnaires, word association test and thematic apperception test is gathered together by the commissioned psychologist who writes out what is known as the 'personality pointers'. These are, as the name indicates, merely pointers to those features in history and personality to which the psychiatrist will pay special attention during his interview.

If there is nothing unusual in the results of these tests and if the other members of the Board are satisfied by what they know of the candidate, there is no need for the psychiatrist to see the candidate. These arrangements have proved very successful in practice where they permit of an initial screening process which has cut down the number of men who have to pass through the hands of the psychiatrist.

*Outdoor testing* - The most spectacular aspect of the Board's work, and one which has given scope for the press photographer is the outdoor testing. There is first of all an obstacle course, the candidate has to climb high sleeper fences, make his way across swinging rope bridges, jump across gaps with the aid of a rope, walk along narrow planks above the ground and so on. The exact procedure varies at different



tencies in their behaviour and these he may refer to the psychiatrist.

*Interviews* - Meanwhile interviews are taking place. The president sees each candidate and inquires into his military record and his civilian occupational background, and in the case of candidates for technical arms, there is also an interview by an officer of the particular technical arm who checks the candidate's technical qualifications.

*Final board conference* - Over the period of two days opinions are arrived at about the quality of the candidate as a potential officer and these opinions are brought together in a conference. The candidate is not present during the deliberations of the Board but makes his appearance in order to ensure identification. The president then asks for the opinion of each member of the board in turn and gives his own. Where the independent opinions are unanimous, there is no further discussion. When differences of opinion occur the president proceeds to explore the reason for the differences and then sums up and gives a final grading. Thereafter the candidates leave the board and the board turns to the reception of a fresh group.

*Follow-up and validation*. - In order to test the efficiency of all this we are of course, undertaking a follow-up. The details of the performance of each candidate will be recorded on Hollerith cards and a random sample will be taken in which the later grading in O C T U and record in commissioned rank will be collated with the Board's findings. So far as this follow up validation has gone, there has been a striking vindication of the value of the new boards. As one might expect from such a very thorough procedure, the quality of the candidates passing the new board has been found to be very much better than the quality of the candidates who passed through the old

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## FUNCTIONAL NERVOUS STATES IN RELATION TO SERVICE IN THE ROYAL NAVY

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The problem of functional nervous states in relation to service in the Navy necessarily differs from that in the other Services. It is of course true that the Navy has on the whole been subjected to more prolonged and severe stress than has the Army or R.A.F. - with the exception of the flying personnel of the latter. But the increased incidence that might be expected to result from this is probably more than counter-balanced by the quality of the men who were in the Navy before the war or who have subsequently volunteered or expressed a naval



the neuropsychiatrists in all the services are apt to see the importance of their subject somewhat out of proportion.

From our experience, it would seem reasonable to suggest that 10% to 15% of the beds of a large hospital should be set aside for neuropsychiatric cases.

*Etiology* - War stress, in the sense of direct experience of enemy action, is not, of course, the only cause of breakdown in wartime. Removal from home and previous ways of living the restrictions and regimentation of service life, and domestic problems, are obviously the important factors in a large number of cases. It is sometimes forgotten that the diagnosis of a functional nervous state depends upon the presence of symptoms rather than upon past experiences which might appear to 'justify' them. It is perhaps of interest that sexual factors have only been found to play an insignificant part.

*Types of reaction* - Gross conversion hysteria (paralysis, mutism) is very uncommon. It was also uncommon in the Navy in the last war. Most of the cases we see show effective reactions, i.e. states of anxiety and depression combined in various proportions, but they are usually complicated or prolonged by hysterical or escape mechanisms. It can be said in crude terms that the better type of man struggles on until he has developed an affective reaction of some intensity whilst the less tough either develop a purely hysterical condition or succumb to quite minor affective symptoms. This difference is well shown in the figures from one neuropsychiatric unit, where hysteria as a primary diagnosis was made in 15% of the ratings admitted and in only 4% of the officers.

Mental deficiency has never been a problem of such magnitude as in the Army and as a primary diagnosis has only accounted for some 5% to 7% of all neuropsychiatric cases seen. A very low level of intelligence as judged by tests is compatible with apparent efficiency in such branches as ordinary seamen or stokers so long as the men are stable. A mental age of 9 years plus (Kent Oral) does however appear to be the lower limit. An intelligence test score is, of course, only one item of information in the diagnosis of mental defect and the stability of the individual often possesses greater practical importance. The wisdom of labelling or dogging men with intelligence test results therefore seems to be most dubious, for their limited, though undoubted, real value is not always appreciated.

Psychosomatic manifestations are very common. 'The nerves go to the stomach' with special frequency or show themselves in the form of headaches. Effort syndrome is rare but is showing signs of increase mainly amongst marines who are called upon to march. Various ocular manifestations are rather frequent. The low incidence of hyperthyroidism is a matter of some surprise for the precipitation of a fair number of cases by severe stress might have been expected but it has not happened.

*Results.*—A great psychiatric lesson of wartime is the adaptability of people and the amount of stress which they can stand. The psychiatrist working in a hospital tends to be unduly pessimistic, a point emphasized by those who have had experience in depots as well. Thus, in one representative depot it has been found possible to keep about 90% of the new cases seen at some form of duty, the remainder are either invalided directly or are referred to hospital. But post-concussional cases do not do well.

In one neuropsychiatric unit about 75% of in-patients were sent back to some form of duty. The average duration of stay was just over three weeks for those returned to duty, and just over four weeks for those invalided. So far as is known the relapse rate is surprisingly small. On the whole a better type of man is being seen as the war goes on. Thus in one depot over half the new cases seen had been in the Navy for over two years. But the major part of our clientele is, and always has been, composed of men who are 'King's hard bargains'. Many have never been to sea at all. The results quoted above may seem good, but many we have sent back to duty are doubtful assets to the Navy. It would have been better for all concerned if these men had never been selected for naval service. We would have invalided more had it not been for the question of example to others. The high wages to be earned in civilian life add greatly to the difficulties.

*Pre-selection*—The matter of pre-selection is therefore of crucial and fundamental importance to service psychiatric work. How effective good selection can be is well shown in the case of submariners amongst whom the breakdown rate is negligible. A careful selection for all men entering the Navy is obviously desirable, but how far is it possible?

It is easy for the psychiatrist when confronted with a man who has broken down to 'job backwards'. The better psychiatrist he is, and the more he knows about his patient, the more comprehensible and predictable the whole thing appears to become. The objection may therefore be made that it is only easy to be wise after the event. Yet it is impossible for any service psychiatrist to admit the validity of this objection when confronted with some of the specimens he is called upon to see and to treat.

Difficulties of this kind have surely arisen partly because the Ministry of Labour medical boards and the fighting services are to some extent at cross purposes. The function of the former is to assess a man's fitness for some form of national service, it is not their function to decide what form that service should take, and still less, for example, to decide that a man is fit for the stress of service at sea. Moreover, much emphasis appears to be laid by these medical boards upon the obligations, and stringent precautions are taken to ensure that men do not evade their duty by feigning illness. No one desires that the lot of the shirker or the scoundrel should be an easy one, but equally, no one

his senses would desire such individuals as members of a ship's company if this could be avoided.

From a naval point of view the following quotation from an official circular to recruiting boards in the U.S.A. expresses the situation admirably and it would be surprising if the other services disagreed.

"The Army is in no sense a social service or a curative agency. It is to be considered neither a haven of rest for wanderers nor a corrective school for misfits, no er-do-wells, feeble-minded persons or chronic offenders. Furthermore, it is neither a gymnasium for the training and development of the undernourished or undeveloped, nor a psychiatric clinic for proper adjustment of adult emotional development. Therefore there is no place in the Army for physical or mental weaklings, potentially psychotic or pre psychotic persons or those with behaviour problems. Men who present behaviour problems in the civilian community will certainly present intensified problems in the Service.

An attempt has been made in the Navy to remedy some of the present defects in selection. The fact had to be faced that a number of men were passed Grade 1 medically who were not Grade 1 from the psychiatric standpoint. Unsuitable men should clearly either not be accepted or should be eliminated as soon as possible. The standards to be adopted for acceptance must depend upon the excess of the supply over the demand and the efficiency of the selection procedure or the purposes intended. The other limiting factor is that certain men are not worth taking at all no matter what the man power position may be. As it is obviously impossible for every man to be seen by a psychiatrist, it was necessary to try to design a system to pick out men who should be subjected to a further psychiatric scrutiny. Carefully selected and trained W.R.N.S. supervised by psychiatric social workers, have been used for this purpose. They check up the forms which all naval candidates at recruiting centres must now fill up about their work record and kindred matters, and ask certain additional questions bearing on stability. This system has been in operation for over a year but for various reasons it has only quite recently been possible to judge of its value. It seems to be an efficient method of doing what it set out to do namely of indicating what men should receive a further individual examination. It has been found that the proportion of men entering the Navy showing anything positive is very small whilst there is a high concentration of positive findings in those who break down.

Finally, it is proper to emphasize that the incidence of functional nervous disorders is largely dependent upon factors quite outside medical control. The Navy is singularly fortunate in this respect in its traditions and high morale and in the quality of its officers and petty officers. These factors enormously ease the burden of those who have the privilege of working in the naval medical service.

It is satisfactory to be able to record that the traditional humane interest shown in the Navy by officers in the welfare of ratings under their command is now flourishing in the W.R.N.S. This is pleasantly illustrated in the story of an officer in that service who was over



heard saying to an anxious girl who had sought her advice, 'But, my dear, you must remember Lady Hamilton was not a member of the W.R.N.S.'

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## NEUROSIS ON ACTIVE SERVICE IN THE BRITISH ARMY

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It would have been satisfactory if we had been able to exclude from active service most of the men who are seriously predisposed to neurotic breakdown, but this has not been possible. The selection techniques of the Army did not begin until a good many men had already been taken into the forces, and a great many highly unstable and unsuitable men were sent abroad quite early. It must not, of course, be thought that we as yet have any method of selection which can distinguish with certainty those men who will break down. We cannot dream of excluding from military service everyone with any neurotic symptoms, for many of them do extremely well and give first-class service.

However well-selected men are, however good their background and their training, they may yet break down on active service. The combination of stresses which come from isolation from one's fellows, lack of sleep, inadequate feeding, coupled with constant enemy bombardment, may bring any man to the breaking point where he is no longer able to control his emotions. We have been told that, in the Norwegian expedition, some 30% of the admissions to military hospitals were cases of battle neurosis, and fortunately a considerable proportion of these were able, after a few days' rest, to get back to duty with their units. We have few relevant figures about that expedition since there was no psychiatrist with the force. Where morale is high we can always be certain that there will be less neurotic breakdown, because men are able, in the company of their fellows, to keep control over their anxieties. The early campaigns in the desert have demonstrated this. The figure of neurotic breakdown in the first expedition to Benghazi was as low as 2%. It was a war of movement and a successful phase of the war. That figure is not likely to be paralleled in any action where trench warfare or its modern equivalent is involved, and we shall have to be prepared for proper treatment in the forward areas for considerable numbers of men when the war reaches a more difficult stage.

It is quite clear that psychiatrists working with divisional troops or an understanding regimental medical officer are the best people to help

in the prevention of battle neurosis. To recognize early when a man or an officer is likely to crack and to take sensible precautions of extra rest or even sending a man down the line for a while is far better from the point of view of conservation of man-power than to wait until he has cracked. Prevention is always better than cure. When, however, these cases do arise, as they must inevitably, then we know from experience that the ideal plan is to provide treatment for them as near to the front line as possible. These cases need reasonably skilled handling in an environment which gives some relative degree of safety. They need sedation and rest, they should be helped to discuss and abreact their emotional experiences and then be given simple psychotherapeutic treatment largely along lines of reassurance. We can expect that 60% to 70% of men so treated will be fit to return to combat, whereas if the symptoms are allowed to persist and the man has to wait some days for treatment further down the line, the proportion capable of salvage will be very much reduced.

Dunkirk cases, which were treated in military and E.M.S. neurosis centres in this country have given us recent experience of value. Compared with the last war, the cases were predominantly marked by obvious anxiety and the proportion of hysterical conversion symptoms was extremely low. This is fortunate, because it saves one complete stage in treatment, and it is no doubt the result of the change in attitude which has made men realize that while fear has to be controlled to experience it is not a shameful matter. It is vitally important from the point of view of maintenance of man-power that we should educate medical officers at every level in the handling of these cases, and that we should do as much prophylactic work as possible, while providing satisfactory and adequate means for dealing with the cases once they have arisen.

APRIL 1943

## NEUROSIS ON ACTIVE SERVICE

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In the European theater we have not been concerned directly with the elimination of potential neurotics at time of selection or with the preventive aspects found in the early classification and assignment of soldiers. On the other hand our experience with neuroses developing under or after combat conditions has been limited. In other words, we are functioning between these two sides of the picture - in the middle, so to speak. We still have the chance to hold from combat service those who are even now showing evidence of impending breakdown. We

continue to have the possibility of getting the right man in the right place before the final breakdown

In this theater, too, and before combat, we are confronted with many cases of full-blown neuroses. At least one-half of our neuropsychiatric disabilities have been diagnosed psychoneurosis. Our policy now is that we must make every possible effort to treat and return to some form of duty in this theater as many as possible of these patients.

Our station and general hospitals have the first chance at treatment and restitution. Since the early diagnosis and treatment of neurosis can and should occur without hospitalization, psychiatric service on an outpatient basis is being developed. Also, we have two neurosis centers. Here, the attempt is made to avoid 'hospitalitis' and to get the patient back into a military atmosphere with military duties as quickly as possible. Following this come the problems of reclassification, reassignment and even retraining. We anticipate the development of special units within this theater in order to meet some of these problems.

Certainly it is among the soldiers with neuroses that the psychiatrist must look for his record of salvage although it may not be for front line duty. Also it is this group that challenges our hopes of prevention as the challenge offers opportunities for fine although difficult decisions. I believe it is generally agreed that the majority of us would break down in some way if the strain be great enough. We have a very long gamut of individual thresholds of emotional responses to stressful situations; it is difficult at times to draw the line between normal physiologic emotional accompaniments and neurosis. Equally difficult may be the prognosis when symptoms have developed.

In previous meetings we have heard reference to neuroses occurring in 'good personalities,' while on the other hand and in contrast reference has been made to the constitutional neurotic. Here, too, the distinction is not always clear. Many of the constitutional neurotics are our old friends who should be labelled psychopathic personalities and not neuroses. A complete study of the personality will show quite often that the neurotic symptomatology is only one aspect and expression of a psychopathic personality. Carrying the viewpoint further, one may claim that there are, for example, hysterical psychopaths who are not showing, or have not yet shown, outspoken paralyzes, sensory disturbances or other symptoms so often associated with hysteria.

To illustrate, I would like to draw a picture of the hysterical personality. The hysteric is not content with the potentialities of his own personality. He feels that he must appear other and more than he is. He is an egocentric in pure culture. He strives for prestige and attention through fictitious manifestations some of which may be physical symptoms. He lives in his own theater and his natural bearing is pose or play-acting. In physique there is some predominance of the leptosomic-aesthetic and a frequency of vegetative nervous system instability. There may be diverse sexual impulse elements and generally a lack of maturity.

in social-emotional development. In temperament there may be great facility in outward expression of emotion, but beneath is coolness due to lack of inner resonance and depth of feeling. It is because of the inability to reach a tolerable compromise between the demands and the renunciation of the impulses that hysterical manifestations, operating over various evasions and repressions, finally become overt. The various weaknesses and divergencies throughout the personality resulting in insecurity and compensated for by ego-overvaluation are fundamental to the symptomatology that may appear from time to time.

In the same manner the anxious, hypochondriacal and the obsessive psychopaths as well as the sexually perverse psychopaths can be described from the point of view of the total personality make up regardless of presenting symptoms. Stating it in another way, the homosexual psychopath is continuously a homosexual and a psychopath even though he is not engaging in homosexual practices.

From the practical military point of view in our army I call attention to the fact that neuroses are discharged from the army as are all medical cases. They are eligible for pensions and usually obtain them. Psychopaths are discharged by Section VIII proceedings which leave no bases for pensions. The diagnosis of psychopathic personality should be made with all fairness and honesty regardless of the disposal methods and the possibility of pensions. Again regardless of which category the patient is placed in, treatment and efforts to adjust him to some kind of military duty should not be discouraged except in clear-cut cases.

It is on the basis of a study of the total personality and not on presenting symptoms that many psychiatric opinions and decisions must be based. Unfortunately in much of this we have no written texts or laboratory procedures that help very much. Unfortunately too, the distinction between normal and abnormal between what is constitutionally and environmentally produced must rest in large measure on personal judgment backed by training and experience. But as Winston Churchill said, 'Nature never draws a line without smudging it

## NEUROSIS ON ACTIVE SERVICE: EXPERIENCES IN THE M E F.

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In any consideration of neuroses occurring under active service conditions the questions of most practical interest and importance are —

- (1) What is the incidence of neuroses in a battle area? Is the problem an acute one and does it constitute a serious wastage or potential wastage of man-power?
- (2) What type of neurosis develops?
- (3) What are the most important causes of breakdown, and, as a corollary, how far can such causes be prevented?
- (4) What methods of treatment have been found most effective, and how far is treatment practicable in a battle area?
- (5) What have been the results of treatment?

The following remarks represent the conclusions formed concerning each of these five questions as a result of experience gained as a psychiatrist with the M E F from 1940 to 1942.

(I) *Incidence* — Although the actual numerical incidence of neurotic breakdown was considerable it was perhaps remarkable, when judged in relation to the extremes of mental and physical stress and strain experienced in so many cases, not that so many but rather that so few breakdowns occurred. Statistics, however, give a very inadequate picture of the situation as a whole, the amount of time and difficulty involved in the evacuation and treatment of psychiatric casualties may often be out of all proportion to the actual numbers involved.

There can be little doubt that if adequate selection of personnel had always been employed before men were sent to a battle area a very marked decrease in the incidence of neurotic breakdown might have been expected.

(II) *Types of Breakdown* — The most commonly occurring neurosis was the anxiety state; next in frequency but much less common was hysteria. Psychopathic personalities were relatively uncommon and had usually been weeded out before they actually reached a battle area.

It is important to differentiate battle neuroses (cases breaking down under the stress of battle) and neurotic sick (cases occurring without relation to battle stress). In one large series of neuroses cases 64% of anxiety states and 27% of hysterical states were found to be directly related to battle stress.

A comparison of two large and unselected groups of Naval and Army cases showed that in the Navy anxiety states amounted to 71% as

against 53% in the Army and hysteria 10% in the Navy as against 18% in the Army. The percentage of battle neuroses was much higher in the naval group.

(III) *Causation* - The ominous significance of a psychopathic previous history was constantly in evidence. 40% of the neuroses cases showed evidence of a markedly bad previous history before breakdown and 20% had suffered from severe breakdowns in civil life. A large proportion of men with a bad previous history broke down before they ever reached a forward area.

The nature of the battle stress varied with the campaign or theatre of war and with the nature of the operations themselves. The most important single factor during the period in question was continued dive bombing in the absence or relative absence of protection, the effect of enforced inactivity under these conditions was often particularly devastating. The highest rate of breakdown occurred during and following the evacuation from Greece and Crete.

In all cases of battle neuroses associated factors both physical (e.g. fatigue, physical ill health, climate) and mental (e.g. domestic stress) were of great significance.

(IV) *Treatment* - It is easier to prevent psychiatric casualties than to cure them, but it is far too late to commence prevention (to develop selection of personnel in other words) in an actual theatre of war: the best selection under these circumstances tends to be a haphazard and fortuitous process and more often it will resemble a process of salvage rather than selection. Selection should start before entry into the Army, should continue through the stage of training and should apply particularly to all drafts for overseas service in an active theatre of war. It is worse than useless to send men overseas where their previous history indicates that early breakdown is likely (these remarks also apply to chronic delinquents who do not unfortunately undergo any sudden reformation by the simple process of leaving these shores).

The further back from a forward area that a psychiatric casualty is evacuated the less is the probability of his ultimate return, the worse the prognosis upon his ultimate efficiency as a soldier and the more serious the possible effect upon other members of the group. Treatment therefore must be immediate and must be measured in minutes rather than hours and hours rather than days. It must be immediately effective and must remain effective. It must be simple, uncomplicated and at the disposal of every regimental medical officer - who must in consequence possess a working knowledge of the diagnosis and treatment of psychiatric cases.

The cardinal factor throughout treatment is rest, and rest can only be procured under active service conditions by full sedation. Barbiturates (e.g. phenobarbitone or medinal) represent the most generally acceptable and convenient sedatives. Intramuscular injections should be given when necessary. In all cases the dosage must be

adequate it is commonly found that too little rather than too much is given. Other measures of treatment such as prolonged narcosis and narco-analysis may be necessary later.

(V) *Results* – Prompt and thorough treatment on these lines will save a large percentage of psychiatric breakdowns and help to retain large numbers of men in the field; on the other hand if evacuation should prove necessary adequate treatment will help the prognosis and lessen the probable duration of treatment.

The results of psychiatric treatment in the Middle East were reassuring, out of 350 consecutive neuroses discharges from one psychiatric centre 71.5%, and out of 625 consecutive neurosis discharges from a psychiatric hospital 92%, were returned to some form of duty within the command. The number of cases that relapsed was relatively small and did not exceed 5 to 10% – these cases did not necessarily represent total loss to the service, during the interval before relapse they very often performed service of the greatest value to the Army or Navy.

APRIL 1943

## NEUROSIS ON ACTIVE SERVICE EXPERIENCE AMONG AIRCREW ON A BOMBER STATION

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Although the incidence of psychological disorder in flying personnel of the Royal Air Force is low, one cannot but be impressed, after more than three years' service in Bomber Command, with the fundamental importance of mental stress and individual temperament in the air warfare of to-day.

In the Air Force, we are faced with the problem of neurosis as it arises in a selected population of very high calibre subjected to stresses of peculiar intensity. The grimmer side of bomber operations has, for obvious reasons, been little publicized. Bomber crews face the prospect of a long operational tour of thirty sorties into enemy territory against the hazards of weather and the terrifying intensity of massed searchlights, fighters and anti-aircraft defences. The problem is complicated by the effects on the nervous system of the specific strains of flight – cold, oxygen lack, acceleration, vibration and what Bartlett calls the 'skill fatigue' of highly specialized performance.

The effect upon the incidence of neurosis in a bomber group of variations in such external factors as could be measured numerically

was investigated statistically. No decisive correlations could be demonstrated between such factors as meteorological conditions, duration and frequency of sorties, and incidence of physical disease. Of some importance was the cumulative effect of the total amount of flying done, but by far the most striking relationship was between the casualty rate and the incidence of neurosis. From this it may be inferred that it is the appreciation of the grave hazard of their duties rather than cumulative fatigue which precipitates breakdown in flying personnel.

The time of occurrence of this breakdown is also important. It was early noted that the incidence of neurosis was related to the proportion of inexperienced crews in the formation. This relationship was due to the large proportion of the total number of cases breaking down in the early part of their operational tour. Clearly individual differences in resistance to the stress of external factors were also involved in the onset of neurosis. The ideal of medical supervision must therefore be to anticipate and prevent by early treatment, the breakdown under stress of men predisposed to neurosis by the nature of their temperamental make up. As Burley pointed out in the last war this is an ideal almost impossible to attain particularly when dealing with the large crew strength of a modern bomber squadron. Some selective indicator of the men most likely to need sympathetic observation of their behaviour and operational performance is obviously required. The brief psychiatric interview developed by Air Commodore R. D. Gillespie is a possible method.

A field study of the use of a modified form of this technique was therefore undertaken. Briefly its aim was to elicit by interview those traits of personality e.g. timidity, unaggressiveness, neurotic response to physical hazard so commonly found in the previous histories of cases of neurosis. On this basis, a general impression was formed of the neurotic predisposition of the subject. A series of 200 aircrew replacements arriving at a bomber squadron were thus interviewed and assessed either as predisposed or non-predisposed. Their subsequent operational careers were then followed up. Particular note was made of their attendances on sick parade, their operational successes and failures and the eventual outcome of their operational tour. The results suggested that predisposition, as thus assessed, was related not only to the likelihood of breakdown but also to the quality of operational performance. Analysis of the medical records further suggested that appearance on sick parade was often antedated by failing efficiency in the air.

The implications of these findings in the supervision of flying personnel are clear. In aircrew under the stress of operational flying, we can see the individual's reaction to fear expressed in bodily dysfunction according to his constitution. The symptom pattern of that



reaction is as infinitely variable as are qualities of temperament, and range from dyspepsias and headaches, variously diagnosed as due to sinusitis or ocular imbalance, to the rheumatic and 'post orthopædic' pains of doubtful origin. It is usually only in the fatigue syndromes appearing at the end of an arduous tour that gross external signs appear such as facial tics, which aircrew themselves term 'the operational twitch'. In the diagnosis of doubtful cases, symptoms without adequate organic basis, which are accompanied by falling efficiency in the air, are nearly always psychogenic in origin.

The psychological outcome of an operational career must depend not only on the stress to which men are subjected but on their temperamental handicap or nervous predisposition, which is modified by their personal morale. The aim of treatment in the field must be directed primarily to the stimulation of that morale and the bolstering up of self-confidence.

It is important that squadron medical officers should appreciate that there is a whole spectrum of temperamental qualities and that each degree of predisposition shades off into the next. In a sense, the gross cases which we see on sick parade are only the results in poor material of the stress and conflict to which few of those intelligent enough to be efficient aircrew are immune.

The disposal of early breakdowns should be swift and clear cut, since neurosis is an infectious disease. The decision in these cases depends on three things—first, the degree of operational stress encountered, secondly, the temperamental handicap, and thirdly, and most important, the struggle put up by the individual in the face of these difficulties. If this struggle has been persisted in to the point of real psychological illness, the case is accepted as medical. If not, it is referred to the executive who must decide whether or not it should be dealt with as 'lacking in moral fibre'. This division of cases, although difficult, is one which squadron medical officers of the Royal Air Force are encouraged to make for themselves, but specialist advice is readily available.

The fatigue syndromes occurring towards the end of a tour are easily dealt with. Immediate removal from operational duties, a short leave and re-employment on non-operational flying is the treatment

flying officers. Given this close liaison, which is the key to success, any squadron doctor, who is sensitive to the myriad patterns of the response to fear, can do much to help the psychologically lame dog over the operational stile and maintain the mental welfare and efficiency of the flying personnel under his care.

FEBRUARY 1944

## OPERATIONAL STRAIN PSYCHOLOGICAL CASUALTIES IN THE ROYAL NAVY

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I have been asked to speak on Operational Strain (psychological casualties in the field) from the naval aspect. I would submit that it would be impracticable to separate out a group of cases or syndrome which we should attribute specifically to operational strain rather than to other causes and that any attempt to create such a category is strongly to be deprecated.

My reasons are (1) I do not believe that, symptomatically psychological casualties in the field differ materially from those that do not occur in the field (2) I do not believe that psychological casualties in the field are necessarily due to operational strain (3) I do not believe that psychological casualties, at least with us often do occur in the field, but rather after it. (4) The conception of an operational strain syndrome runs the grave risk of creating an honourable as opposed to a dishonourable or at least less honourable one.

It is less misleading to bear in mind the old platitude that men break down as the result of every conceivable combination of pre-disposition and external stress, both physical and mental and that this is equally true in war as in peace. In wartime, moreover there is the very real danger of over-emphasizing the dramatic, such as exposure to enemy action when less dramatic events, such as the regimentation of service life separation from home and domestic difficulties may really possess more significance. Indeed the striking lesson brought home to us by the war is the amount of operational strain the average man can stand especially if this operational strain is imposed or with drawn gradually. Sudden alterations of tension are what get people down. Sudden reductions of tension are a particularly potent cause of men succumbing to stress and going sick. These reductions of tension possess special medical significance since we may be able to do some thing for those who experience them. We cannot do much about air

bombing, but we may, with varying degrees of sense and sensibility, be able to do something about a survivor. We are becoming increasingly of the opinion that the best treatment for many of our cases is to recommend a draft to sea again as soon as possible. Certainly the worst treatment for many of these cases is to send them into hospital.

The fundamental question of predisposition, and hence the importance of selection, is singularly well illustrated by our submariners. Few men are exposed to more operational strain than those who serve in submarines, and yet the number of submariners who have had breakdowns of sufficient severity to reach the naval neuropsychiatrists has throughout the war been so small as to be negligible. For example, we only knew of 26 cases of all ranks during the whole of 1940 and the incidence has shown no sign of increase. Moreover, in a substantial number of the cases, the reasons for the breakdown have been unconnected with operational strain and have been attributable to incidental factors such as domestic difficulties.

The above facts are, amongst other things, a striking tribute to the excellence with which the submarine personnel has been selected.

Our war experiences, however, have substantially modified the views we started with about predisposition and selection. We made the mistake of being far too pessimistic about what the average man, and in particular about what the average neurotic, can stand.

There is no doubt whatever that those who break down show a high concentration of certain ominous points, such as poor work record, compared with those who do not. According to certain investigations we have made, the proportion showing these ominous points amounted (with the technique used) roughly to 60% of psychiatric in-patients and 50% of psychiatric out-patients as compared with only 15% amongst 'normal' sailor controls. Yet our psychiatrists now keep nine out of ten of the men referred to them as out-patients at duty and send back to duty two out of three of their in-patients. Moreover, our relapse rate, as judged by readmission to hospital, does not seem unduly high. Thus, according to an investigation made last year, we were returning psychiatric cases to duty from hospital at about five times the rate at which relapsed cases were being readmitted, and about half of these relapsed cases had remained outside hospital for more than six months.

The significant point about these findings seems to be that, although a high proportion of those who break down not only give a past history which suggests their predictability as bad psychiatric possibilities, but have also shown that they were bad possibilities by having broken down, yet it is still possible to send the majority of them back to duty and to retain a relapse rate that seems reasonably small. Even amongst those that are finally invalided for psychiatric disorders two-thirds have survived in the navy for over a year. In brief, many

had psychiatric possibilities give reasonable service before they break down and are also capable of giving further reasonable service after they have done so

The standard adopted for rejection, or the exclusion level must naturally depend upon the available manpower but a percentage does remain that should be rejected no matter what the man-power position may be. It seems doubtful however whether with our intake as it was and with the man-power position as it was the proportion that should certainly have been rejected amounted during the last year or so to more than 1 to 2 %. I may add that our selection procedures for early psychiatric weeding have been so sketchy as to be almost imperceptible. One great stand by has doubtless been the self selection consequent upon men expressing a naval preference at the time of their call-up

The main conclusion I have been able to draw from all this is that the men who break down in wartime are often predictable, but that in practice it does not matter as much as one thought. It is the experience of my colleagues and myself that they are now prepared to take risks which previously they would have considered quite illegitimate

TABLE - PSYCHIATRIC 'CASUALTIES' AFLOAT

Ship	Approx. Complement	Period observed (years)	No. of psychiatric cases sent sick or ashore
1. Battleship	1 700	1 (1942-1943)	14
2. Cruiser	900	2 (1939-1941)	1 (+ 2 homes.)
3. Cruiser	850	1 (1939-1940)	8
4. Cruiser	800	3 (1939-1942)	2
5. Cruiser	650	2 (1941-1943)	6
6. Cruiser	450	1.5 (1939-1941)	8
*7. Cruiser	450	.75 (1939-1940)	1
8. Aircraft Carrier	800	2 (1939-1941)	7 (+ 6 flying)
*9. Destroyer Repair Ship	900	2 (1940-1942)	6
10. Destroyer	185	1.5 (1942-1943)	0
11. Destroyer	150	.75 (1942)	1
12. Destroyer	125	1 (1940-1941)	2
*13. Destroyer	150	1.5 (1940-1941)	0
14. Destroyer	165	1 (1942-1943)	0
15. Destroyer	170	3 (1942)	0
16. Destroyer	170	5 (1943)	3
17. Frigate	155	1.5 (1942-1943)	2
18. Sloop	135	2.5 (1940-1943)	4
8,905 men			60 cases

\*Denotes ship sunk.

Note - The 60 psychiatric casualties correspond to an annual psychiatric sickness rate of 4.3 per 1,000. This may be compared with a figure of 3.8 psychiatric casualties per 1,000 total naval strength (adjusted to cover the same period)

Starting with the psychiatric problems seen afloat, one has repeatedly been struck by meeting naval medical officers who say that although fear exists in plenty, psychiatric cases do not

The table on the previous page was compiled from the information kindly provided during the last fortnight by 18 naval medical officers now serving in 4 different naval hospitals

It will be seen that the first column deals with the type of ship, the second with the size of the complement of that ship, the third with the period of service in the ship of the medical officer in question, and the fourth with the number of psychiatric cases that had to be taken off duty not all were sent ashore. It will be observed that the number of psychiatric 'casualties' is remarkably small. The figures can only claim to be approximately correct, but I do not think that in fact the incidence was much higher than that indicated. I may add that nearly all the ships saw action, that the number of men killed in them as the result of action was considerably greater than the number of psychiatric cases, that three of these ships were sunk; and that the experiences covered a wide range of naval duties including Norway, Malta convoys, evacuation of Crete, convoy work all over the world and even service in the Persian Gulf.

On the other hand, if one talks to the medical officers serving in naval establishments ashore such as drafting depots, one meets with a very different story; for they are keenly aware of the size and importance of the psychiatric problem in naval medicine.

The difference in the incidence ashore and afloat of psychiatric cases is also brought out by calculations kindly made for me by Surgeon Commander J. A. Fraser Roberts. Thus the sixty psychiatric 'casualties' in these 18 ships correspond to an annual psychiatric sickness rate of 4.3 per thousand. This may be compared with a figure of 3.8 psychiatric invaliding per thousand total naval strength (adjusted to cover the same period). The psychiatric sickness rate afloat is thus not much higher than the psychiatric invaliding rate for the navy as a whole.

I do not believe that this striking discrepancy can be wholly accounted for by the silting up and concentration of the despised and rejected ashore. Nor do I believe that the cynics are correct in supposing that the men who report sick ashore with psychiatric symptoms necessarily do so mainly with any conscious or unconscious intention to evade their draft or their duty. And I certainly do not believe that many of them fake their symptoms. I would submit that a potent factor not sufficiently recognized is the disturbing *reduction* of tension already mentioned. If a mechanical analogy may be permitted, it is as if men who are exposed to operational strain (and all men afloat are exposed to some operational strain) need to 'rev up' their engines to make the grade. When the need to keep up this pace is suddenly withdrawn, they find themselves incapable, so to speak, of

reducing their speed become uncomfortably conscious of this and develop symptoms because they are unable to adjust easily to the different tempo. It would, I think, be a mistake to seek for the origin of these symptoms at a more purely psychological level.

It seems reasonable to regard the process as analogous, in slow motion to the normal experience that one may feel worse after danger than during it: the reaction after any excitement is often more disturbing than the excitement itself, especially if we have nothing to distract our minds or to give us an outlet. One is tempted, for example, to regard the uneasiness that certain combatant officers show when they are away from the front line, or the desire fighter pilots may manifest to spend their leave either spotting in the Channel or at sea in a destroyer as being an expression of a biological need to sustain tension. One sometimes feels that such men would be broken by a régime of slothful peace and plenty and require excitement to sustain them. And indeed one does see often enough men with first class personalities such as C.P.O.s, who do crack, and crack badly with the enforced sudden reduction of their tempo imposed by admission to hospital for some incidental physical ailment, with all the possibilities for idle rumination this too often entails.

The difficulties and breakdowns that occur in civilian life on retirement are perhaps examples of the same principle.

In summary, people miss the stimulation to which they are accustomed even if it is unpleasant, and as they say, cannot stand doing nothing. This is a frequent cause of symptom formation.

The above hypothesis also provides an additional rationale for the sedation that is so valuable in the acute stage, for this reduces the tempo by chemical restraint, and for the desirability of sending men back to duty before the habituation of doubts about future capacity have occurred. These in time become coupled with a real reduction in tempo that it may be very difficult to raise again. One certainly feels most dubious about the future efficiency of those who blandly say they cannot go to sea again and present no symptoms but one is becoming increasingly optimistic about the capacity to do so of those with quite severe symptoms so long as they are reasonably recent.

I do not, of course, wish to suggest that this factor of reduced tension is the whole story but merely that it is perhaps a somewhat neglected part of it. Lack of time rather than lack of their importance stops me from dealing with the numerous other questions that so obviously play their part in affecting the incidence of neuroses such as discipline, leave, mail, what are felt to be inequalities in treatment—to mention only a few. We are, of course, singularly lucky in the navy in having a tangible object, which is also a home, around which group loyalty can centre, namely the ship. An airman or member of the tank corps cannot feel about their contraptions in quite the same vivid personal

way Yet the life of a closed community as in a ship has its special dangers, and interesting paranoid reactions rather similar to those seen amongst prisoners may occur when the commission is too long or the ship is not a happy one

Nor need I speak of the 'leadership qualities,' as I understand it is now fashionable to call them, of that remarkable caste, the regular naval executive officer, into many of whose heads the idea that they would not get implicit obedience from a rating has not entered since they joined Dartmouth as boys One medical officer has told me how the captain of his cruiser was in the habit of addressing the troops on Sunday after divisions rather in the manner depicted in the film 'In which we Serve' This captain was a strict disciplinarian who did not however arouse any mass 'teeth-sucking' The ship had had a very hard time and a few cases of neurosis had occurred One day the captain finished his address by saying 'I am getting fed up with this thing called anxiety neurosis I have arranged with the P M O to interview all such cases with him before a final decision is made to send anyone else to hospital' My informant said that although this was annoying the results seemed to justify the step for no more cases of neurosis occurred, or at least appeared at the sick bay

Whilst leaving to others the numerous other problems that arise I feel that I may perhaps be permitted to conclude with, so far as I am aware, a new criterion of improvement, or at least one not explicitly set forth in the medical literature The scene was North Russia after a famous convoy with many casualties My medical informant told me that some concern was felt about the survivors who were much shaken and, it was felt, unhealthily addicted to the discussion of their recent terrible experiences, coupled with criticisms of those who might be held responsible One day the chief petty officer announced 'The men are all right again, Sir, they have gone back to talking' and he used a less polite word than sex

OPERATIONAL STRAIN PSYCHOLOGICAL  
CASUALTIES IN THE FIELD

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I have no desire to enter into a controversy regarding who is subjected to the greatest strain—the flyer, the sailor, the tank man, or the foot soldier. It is my opinion now that regardless of many varying conditions, the general continuing stress for the infantryman is as great as that experienced by those in any other branches of the services. I do not believe that, under combat conditions, purely physical causative and resultant factors can be separated from emotional and psychological factors. The two are mutually contributory, one to the other. The vast majority of men coming back from combat with nervous symptoms are exhausted, and the majority of thoroughly exhausted men show unsteadiness and even tremors, loss of efficiency, disturbed digestion, and complaints of headache, bodily aches, and loss of strength. These are the very symptoms seen in the more outspoken neuroses. In ordinary life fatigue brings aching muscles; the tired business man is irritable; the exhausted child cannot fall asleep; strain often produces headache, and long hours of work lead to lowered efficiency. Usually, the psychological factors are more important, but there is such a thing as exhaustion of psychological and emotional functions.

For the foot soldier, extended periods of waiting and training produce strain, even if the physical condition is brought to peak. During this time the emotional tension may be considerable owing to new adjustments away from home and anticipated dangers in the future. It is during combat that the real test comes. The soldier goes into battle with streamlined equipment which usually includes a blanket, or at most two, and possibly a raincoat. Extra socks are not numerous and for days the shoes may not be removed. Sleep is spasmodic and totals at best only a few hours out of every twenty-four. Blankets are wet, and frequently the sleeping cannot be done lying down. The slit trench is likely to have mud and water to some depth. Two tins of rations per day contain enough calories, but the supply is inconsistent, and the sameness of food leads to loss of appetite. It has been established that caloric deficiency (not vitamin deficiency) under conditions of hard work produces some deterioration within a day or two. This deterioration involves (1) psychomotor performance, (2) cardiovascular adjustment, (3) metabolic functions, and (4) simple muscle strength. It would be interesting to know what happens under sustained combat conditions to nitrogen metabolism, fat metabolism,



and the functions of the adrenal cortex. Isolation in a foxhole for hours brings a feeling of aloneness, fighting without assistance, and no help if wounded. Emotional tension produces muscular tension with resulting fatigue.

In the winter mountain fighting in Italy a cold dismal rain drips steadily on the infantryman. Movement is through mud, and foxholes are even muddier. Snow is on the heights, and often descends to the main roads. The fight goes from ridge to ridge, along twisting roads that run three miles for every air mile. Heights are taken at night after hours of artillery fire, and counter attacks are repelled during the day. Crossing a river near the shore and elsewhere brings the problem of establishing a bridgehead under fire and uncertainty about supply of food and ammunition. These situations take on added significance from the standpoint of exhaustion when it is remembered that they are endured without relief for at least a week and often several weeks at a time.

To make the picture more vivid, and produce a different setting, let me quote from a description concerning Guadalcanal.

'All of these men lost weight and none of them were pudgy when they landed on the beach. Weight losses in muscular, toughened young adults ran as high as 45 lb or over 3 st. Rain, heat, insects, dysentery, malaria all contributed, but the net result was not blood-stream infection, nor gastro-intestinal disease, but a disturbance of the whole organism. A disorder of thinking and living, of even wanting to live. As weeks passed hope left most of these men. Soon they were sure that they were expendable, doomed. Fatigue wore them down, painful aching fatigue that they felt could never be relieved or cured.'

In North Africa, Sicily and Italy, the psychiatric casualties have amounted from 10 to 15% of all non-fatal battle casualties. The percentage has varied from time to time and on certain occasions has for a day or two been as high as 33%. Increases in incidence came just on the threshold of starting action, at the end of a long campaign, and during reverses. The rise in incidence after six or seven days of continuous fighting was consistent. A composite curve based on all the different battles showed a slight rise in psychiatric casualties on the second and third days followed by a drop and then a distinct increasing per cent from about the sixth day onwards, the observation of peaks of psychiatric casualties coming about two days after the peaks of wounded has also been consistent. For example, in an engagement lasting from March 28 to April 8, 1943, the wounded casualties were the highest on March 29, 30 and 31, and April 1, while the psychiatric casualties were highest between April 1 and 4.

These observations suggest that fatigue should receive more serious consideration. Guadalcanal and other experiences have shown that the best soldiers will break if the stress is long and severe enough. More definite rest periods have been instituted, but still they must depend upon the tactical situation. It is believed that battalions should have a day or two of rest about every seven to ten days. This would be

just behind the front where there is chance to have several hours of sleep, some hot food and relief from constant vigilance. The chance to wash and shave also is very welcome. It is thought that divisions should have a longer period of rest about every four to six weeks. This entails the provision of a camp not near a city but where there are recreation facilities, cinemas and supplies of clean clothes. Objection may be raised on the basis of reducing manpower at the front and some may wonder if the enemy is doing the same. However the resultant saving in man power would probably more than compensate in the long run.

A few words should be said about diagnosis and early treatment. First of all, it has been found to be very important that only the term exhaustion be used as a diagnosis on the emergency medical tag. Naturally the soldier reads this diagnosis and the term exhaustion suggests to him a natural occurrence and speedy recovery. Treatment, too is essentially that of overcoming an exhausted state, and includes sedation, sleep food and reassurance. Certainly in the milder conditions much of this can be done and has been done near the front. It is nothing new for a good medical officer to recognize the soldier who is becoming tense and irritable and showing signs of exhaustion, and then to give him a chance to rest for a few hours. As an example, a surgeon with an attached artillery unit had some stretchers and cots in his aid station where he often kept men overnight in order to give them sleep under sedation and some hot food. In the majority of instances he was able to return these men to duty the following morning and he stated that none of them had come back to him unless wounded. In one evacuation hospital the proportion of psychiatric casualties had dropped from 14% to 5% and the psychiatrist of this hospital attributed this in large measure to the excellent preventive work and early treatment carried out in two regiments of the division in which he was serving where 50% of the neuropsychiatric casualties were sent back to duty from battalion aid stations.

The appointment of division psychiatrists in our army will prove to be an important step forward in the handling of these conditions. This was demonstrated in the last war and has been demonstrated again in Italy by the corps psychiatrists of the British Army and the division psychiatrist of the Canadian Army.

## OPERATIONAL STRAIN · EXPERIENCES WITH THE MIDDLE EAST FORCE

BRIGADIER G W B JAMES, C.B.E., M.C.

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For three years I have been helping to deal with the psychiatric casualties of a force in the field – the Middle East Force – and it is the result of this experience that leads me to lay stress upon certain aspects of the problem of psychiatric casualties in the field

Experience has shown me that a ruthless selection is the best way of reducing these casualties to a minimum but I want to stress that however careful we may be, we shall still have psychological casualties to deal with in the field. No amount of selection or screening can get away with the tremendous physical and emotional strains and stresses set up by battle. The mental quality and morale of troops required to fight a campaign will decide the issue of the campaign. It is, therefore, never useful to put into the field ill-selected, untrained, ill-equipped men and call them soldiers. Too many people seem to believe that when a man is issued with a suit of khaki he puts on with that suit the attributes of a soldier, attributes which can be learned only by patient and prolonged training. The reinforcements arriving in the Middle East Force for long showed a complete absence of psychiatric screening even of a primitive kind. I remember talking to a man in the hot summer of 1941 and asking him what his chief interests had been in his childhood. He replied that he had always loved skipping, knitting and talking with the girls! Yet this man, a determined homosexual, was sent halfway round the world as a representative of the armed forces of his country at a very critical period in that country's history. The first great and essential lesson of experience is the necessity for selection. There is no room in an army calling itself modern for dullards or lifelong neurotics.

It must not be forgotten that psychological casualties, at any rate a proportion of them, will require beds. What is the number of psychiatric beds with which a force should equip itself? My experience teaches me that two beds for psychiatric casualties per 1,000 of the force is about the right number and should allow for adequate treatment within the force itself. This is an important matter. Evacuation should not be made too easy, and treatment, rehabilitation and return to duty, even if it is not necessarily combatant duty, should all be carried out within the command. Two psychiatric beds per 1,000 of the force should permit this to be done.

The first-aid treatment of psychological casualties must be widely

disseminated among all medical officers. My own teaching on this matter is summarized in the simple text: Fluid, food, sleep and stool. Much of my experience was gained in desert conditions. Men who broke in battle came down to their distant psychiatric centres dehydrated, remarkably constipated and very often sleepless. The length of the journey did not matter a great deal provided these cases were adequately sedated on the journey. The nearer to the front that expert treatment can be given to the soldier breaking in action, the better. That is an axiom with which I know all will agree, but treatment, even when only for a few days, should be carried out beyond the noise of near artillery in an area where bombing is not too frequent. A little bombing is not a bad thing as it helps patient and doctor to decide on the results of therapy, but areas in which raids are very frequent, both by day and night are highly undesirable for the treatment of psychiatric casualties.

Experience has taught me several other points. One is the need for good rehabilitation. The stay in hospital should be reduced to a minimum and in the Middle East we sent our casualties on to a convalescent depot where a psychiatrist had charge of a suitable number of beds.

After rehabilitation there is need for an organization which will get recovered men back to their duty with the minimum of waiting. Sometimes when battle fronts move very quickly, journeys back to units may take a long time and unless this return journey is well organized, men may get what they call 'browned off' before they reach their units. Reception into the unit should be studied and made pleasant or at any rate not actively unpleasant. Psychiatric casualties are too apt to be received with a surly growl - 'So you're back, are you?' or 'My God, who sent you up here!'

It is bad for the reputation of the medical services to send psychiatric casualties back to combatant duty only to relapse within a short period. So that in the psychiatric arrangements for an army it is wise to have a re-selection of men before they return in order that suitable fresh employment may be found for the great majority of psychiatric casualties, if only for a period.

It is difficult always to forecast the rate of psychiatric breakdown. It differs with the terrain on which battles are to be fought; it differs with the success or otherwise of the operations. Heavy actions fought over a week or more in time are more productive of breakdown than lighter and speedier engagements. Close country gives a greater psychiatric breakdown rate than open or desert country; some enemy weapons have greater effects on the morale of soldiers than others. All these factors, therefore, will affect the rate of psychiatric breakdown.

## OPERATIONAL STRAIN: STRESS IN COMBAT FLYERS

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It is my intention to speak of the changes that have taken place owing to emotional stress in combat flyers in heavy bombardment in the United States Eighth Army Air Force during the time that they have been flying operationally thus far

The persons involved were a highly selected group. They were selected in the first place by their voluntary choice of flying, secondly, by psychological and intelligence testing and by rigidly standardized physical examination, thirdly, by a considerable natural selection inherent in the several stages of flying and operational training. To cite a recent survey on a large group of successful heavy bombardment flyers — they tended to be not only young but to have few major home responsibilities. In general, although roughly one-third of them had evidenced definite psychoneurotic mechanisms in the past, their life patterns were characterized by great vigor, persistence and physical health. Their life patterns showed a singular absence of asocial acts. They came from large families. Their motivations were diverse. A considerable number volunteered for flying in the first place in order to attain higher rank, 'glamor,' extra pay or other symbols of social approval. A considerable number originally were motivated by a desire to fly. Very few were originally motivated by conscious hate of the enemy and few more developed such feeling. The motivations that developed through training and combat to the point of giving solid support seem to me the complex drives dealing with the relations of a man to his fellows. He found himself a part of several groups — most particularly squadron and crew, with which he identified himself strongly, upon which he depended, and in which he was important. If he ceased to be adequate in conforming to the standards in these groups, he suffered in loss of pride and ego strength. These factors appear to be the key to endurance of stress in these men.

In regard to the stress under which these flyers operated there are several relevant matters to consider. The traumatic factors, however, which seem to have had the importance of major stress in an almost universal way include. The fact that on a statistical basis during the past year these crews have had little chance to survive and only a small proportion did survive, the fact that most of them (confirmed by recent survey) endured close-up, first-hand catastrophe — ditching in the North Sea, wounds, fire, crashing, baling out and so on, and

essentially all had seen their fellows being maimed and killed by gunfire, being frozen at 65° below zero temperatures, rendered unconscious and dead from anoxia, being disintegrated by explosion, falling out of control and with parachutes aflame, and crashing in mid-air in the meticulously tight formation it is necessary to fly the deprivations of normal satisfactions, the restrictions on personal initiative, the sometimes apparent undependability of the authority upon which survival depends, and the breaking-up of powerful group ties, all inherent in overseas army life itself the remarkably difficult situation in daylight heavy bombardment, of not feeling able to fight back against or make any move to escape from attack by flak and fighters, so that built up tension has no release the fact that in this type of operation there are few if any, visible, personal, satisfying results of the work and the fact of the complete interdependence of each crew member, each ship and each squadron in a group which makes it possible and easy to feel responsibility and then guilt for the loss of one's colleagues.

Virtually every man exposed to this stress experienced conscious anxiety and other symptoms as well. The most common of these symptoms were beginning phobic translations of anxiety loss of appetite, nausea and weight loss, insomnia and vivid battle dreams tremor tremendous irritability pronounced depression with self accusatory coloring and the inability to enjoy and concentrate and make decisions in any activity other than combat flying. Most of them flew and flew quite efficiently with the symptoms. In the majority whether the flight surgeon or commanding officer took them off flying status or not (a decision made largely on the basis of the effect of the symptoms on efficiency in the air) the symptoms were accepted with remarkable insight as a part of the circumstances of their position. In the majority the symptoms were not used for the secondary gain of removal from combat. These men not only knew anxiety irritability and self-accusation quite well but spoke of them freely with each other. They did not castigate the colleagues whose anxiety had made them ineffective and so removed them from combat flying but they seemingly did everything possible not to be removed themselves and to return to combat with the crew if they had to be taken off.

I would propose then that almost all these men are capable of becoming less adequate and adaptive for their present situation under prolonged tension. I also propose that essentially all, both the very stable and the markedly neurotic are capable of long continued endurance and efficiency when they are forced to identify themselves with a group. It is apparent that the problem of feeling appropriate fear again and again and again has no solution that is both painless at the moment and entirely satisfactory in the long run. In such circumstances the tensions come to persist regardless of external stimulus and become anxiety' in the sense that it becomes free floating

attaching itself to other symbolic matters, reactivating long forgotten fears from the past and being neurotically solved by mechanisms which are usually regressive ones. It is worth while to speculate whether the term 'neurosis' fits in this context, whether it is here significantly adequate. When strong anxiety is not only the sole response appropriate to the situation, but is felt, accepted, and not permitted to stop the work to be done, by essentially every person in that situation, it certainly does not have several of the connotations which attach to the word 'neurosis'.

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## MANAGEMENT OF COMBAT EXHAUSTION IN THE ARMY

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Some comparison of the organization for treatment of combat exhaustion between the U.S. Armies and the British Armies is in order. We have no provisions at corps level such as occur in the British Armies, but depend on division psychiatrists and exhaustion centers - the latter serving an army as a whole. Also we have a psychiatrist for each army rather than one for each corps.

Under the topic of management it is appropriate to consider prevention because there is no distinct dividing line between prevention and treatment. Line officers as well as all division medical officers have had some indoctrination in prevention and early recognition of combat exhaustion, but perhaps not enough. Emphasis has been placed on the quality of leadership as a priority factor in prevention. In prevention it is important that soldiers be fitted into their proper assignments so the job is neither too big nor too little for their abilities and training. Selection, classification and assignment should be a continuing process in all units. Adequate training, indoctrination and discipline add to the soldier's confidence in taking care of himself. The manner in which reinforcement troops are introduced into the unit and into fighting is extremely important. Line officers are now recognizing the need for relief and rest of combat units and plans along this line are in effect whenever the tactical situation permits. This is better than to wait for individual soldiers to become medical casualties. Officers know the approximate number of continuous combat days that the average soldier can take under varying conditions before he is worn out. The soldier must have some goal other than death, maiming or psychiatric breakdown. The medical officer with combat troops has been schooled to be on the lookout for the man

who is getting jumpy, going off by himself, becoming sleepless, losing appetite or showing other symptoms of undue strain. The good medical officer sees that his men are as comfortable, as well fed and as clean and dry as possible under any given set of circumstances. He has an interest in their everyday life their sports and their equipment, and he shares their dangers and hardships.

Concerning treatment practically all front line medical officers have had a one week practical course at our School of Neuropsychiatry in what we call first aid psychiatry. Here, the medical officer is taught to recognize early symptoms and send a soldier back to the kitchen area or similar place where he can get a good sleep perhaps with a little sedation one or two hot meals and a chance to wash shave and dry out. Of course the personal contact the explanation and reassurance given and the temporary relief from constant vigilance are important factors in this first aid. Just how many men are so treated and return to duty the following day is not known because no records can be kept, but there are many of them. Several divisional surgeons have told me that at least 50% of the combat exhaustion cases are returned to duty in this way.

If the symptoms are too pronounced for this simple treatment the soldier is evacuated under sedation to the clearing station. Sedation during this process not only renders the job easier and makes the patient more comfortable but it is the start of real treatment. Patients arriving at the clearing stations under sedation are in much better condition than those sent back without it. It appears that fixation of symptoms also is prevented.

At the clearing station the patient may be kept two to four days under the care of the division psychiatrist in ward tents separate from other conditions. For the majority of patients so held sleep during the first twenty four to thirty-six hours is insured with due attention to nutrition. Sodium amytal is used so that the patient sleeps through the night and naps in the forenoon and afternoon. At least another day is given to occupation, recreation and group or individual talks. In some divisions more extensive rehabilitation programs have been tried. Hysterical symptoms usually respond readily at this level to suggestion therapy - with or without the aid of drugs.

In three of our armies now in combat there are at army level additional neuropsychiatric facilities called exhaustion centers. These are makeshift organizations - having a housekeeping unit such as a clearing company and being manned by neuropsychiatrists on detached service from evacuation hospitals. These are mobile units and can be moved as a whole or divided for moving as the situation dictates. Here, the patients can be held longer (seven to ten days) and the treatment - especially the rehabilitation program - can be much more thoroughly carried out. An exception to the above is found in the 3rd Army where the neuropsychiatrists have maintained





## THE PREVENTION OF VENEREAL DISEASE IN THE ROYAL NAVY

SURGEON VICE-ADMIRAL SIR SHELDON DUDLEY, R.C.N., F.R.C.

*Medical Director-General of the Royal Navy*

I have brooded on the problem of preventing venereal disease in the Navy for thirty-eight years without getting any nearer a solution. Therefore as a disillusioned old man let me draw your attention to a few aspects of the subject which tend to be forgotten by the young and enthusiastic social reformer.

The psychological factors which frustrate many of our efforts in the preservation of health are nowhere so marked a cause of obstruction as in our attempts to reduce the incidence of venereal disease. This fact must ever be borne in mind by the social worker. I deliberately say social worker instead of doctor because the control of venereal disease is far more a problem in social behaviour and herd prejudice than one of mere medical administration.

Lectures, with the intent of trying to inculcate clean living on ethical and moral grounds, are almost doomed to failure when we are dealing with adult sailors living the crowded community ship life away from home and family influences because the large majority of adults have already formed their attitude towards promiscuous intercourse and rationalized their sex behaviour with any religious or ethical code they profess.

The great force of the sexual instinct, which is continually working against our efforts to inculcate chastity as the one sure shield against contracting venereal disease, is the reason why the mere telling of men, however forcibly not to touch loose women has produced no measurable results on the morbidity of venereal disease.

The self preservation instinct, that is the inculcation of the fear of getting venereal disease or the fear of punishment for getting venereal disease has been largely used in attempts to oppose the desire for women, with as far as I can judge no success. Apart from the ethical and psychological desirability of encouraging the uninspiring safety first principle in fighting men, the use of the horror type of lecture or film has the great drawback of placing the medical officer in an invidious position. He gives a lecture which implies that if you get venereal disease you will become a cripple, die in the madhouse, and ruin the health of your wife and children. Immediately afterwards he adjourns to the sick bay, and reassures one of his audience who has got venereal disease and is in a suicidal condition of panic fear that he need not worry as provided he sticks to the treatment, he will be

permanently cured. Such a complete *volle face* on the part of the lecturer does not tend to increase the confidence of a ship's company in their medical officer.

A difficulty with all health propaganda is the great care that must be exercised not to increase ill-health by causing hypochondria or disease phobias, because it is most insanitary for a man to think overmuch about his health. Let us be honest anyhow in our lectures on venereal disease, because early and properly treated venereal disease is a trivial complaint which should cause little or no disability.

Fear of punishment as a deterrent is condemned by most senior naval medical officers. It is doubtful if punishment has any effect on sex behaviour. It certainly leads to concealment of disease, inefficient treatment, and increased spread of venereal infection. The use of local disinfection or condoms is a thorny subject. One thing must clearly be kept in mind. As Service doctors our only duty is to keep as many men in the fighting line as possible. Therefore, even if it is true that self-disinfection increases the amount of illicit intercourse by removing fear of the consequences, it is no affair of ours, and it is our duty, despite any personal feelings on the subject, to encourage the use of such measures if we honestly believe the amount of disease is reduced thereby. In the Navy we prefer the use of the sheath or condom to any packet system. We have abandoned ablution chambers in ships as useless and the use of sulpha-drugs and penicillin as prophylactics are still in the experimental stage. Condoms are more efficient and foolproof than packets, and a sheath also has the advantage of protecting the female from infection and pregnancy.

The statistical evidence I have examined is not good enough to persuade me that condoms have had a significant effect on total venereal morbidity. However, maybe they can diminish the number of cases over short periods and combined with effective propaganda may save considerable man-power during the period of an operation.

Another obstruction to the effective control of venereal disease, which is not always realized to the extent it should be, is the innumerable pitfalls in collecting and interpreting statistical data on venereal diseases. There is no time to discuss this vast subject in detail but as a glaring example of the unreliability and illogical interpretation of venereal statistics, the alleged effect of the action of alcohol on the morbidity of venereal disease may be briefly considered.

Year after year, in the official report on 'The Health of the Navy' in the section of the steps taken to prevent venereal disease, it was stated that much improvement in venereal morbidity was to be expected as a result of the steps taken to increase the temperance of the sailor, and many experienced Service venereologists attribute great weight to alcoholism as a factor which determines the magnitude of venereal disease rates. I have heard one venereal disease specialist proclaim that 75% of his patients were drunk at the time of infection.

and the remaining 25% had taken drink when they contracted their venereal disorders, and that he was convinced alcoholism was a major cause of venereal disease

A sympathetic medical officer went into this matter rather carefully some years ago and after having got their confidence, many venereal disease patients who had at first stated that they were drunk subsequently admitted that they were not intoxicated at the time they contracted their disease, but they had said they were because they knew that they would be regarded as more unfortunate than sinful, if they said they were drunk. There is no suggestion that the inhibition of judgment and self restraint or carelessness in taking reasonable precaution due to alcoholism does not account for an unknown number of venereal infections but it is essential to realize that there is no reliable statistical evidence of what fraction of venereal disease morbidity can be reasonably attributed to this factor. All we do know is that the tremendous change for the better in the drinking habits of the naval personnel, which has taken place in recent times, has not been associated by a commensurate fall in the incidence of gonorrhoea

This is an example of the caution necessary in the interpretation and collection of all medical statistical data.

So far I have been pessimistic. However when we consider treatment in connection with the prevention of venereal disease the outlook seems brighter. Coincident with the introduction of arsenical drugs the incidence of syphilis in the Navy dropped rapidly from about 30 to 4 per 1,000. It was hoped that the introduction of the 'sulpha drugs' would have the same effect on gonorrhoea as the arsenicals had had on syphilis, but the naval figures show little indication of this as yet which is perhaps not surprising as syphilis is a disease conferring permanent immunity while gonorrhoea does not. Whether the extreme rapidity with which penicillin disinfects the carrier of gonococci will have a greater effect on lowering the incidence remains to be seen.

Now there is a last but most important point. Our one duty as naval medical officers is to keep as many men at the guns for as many days as possible, as our American naval colleagues say and if we cannot prevent cases, we can prevent some thousands of days sickness by refusing to hospitalize venereal patients. Simple uncomplicated primary syphilis and gonorrhoea are easily treated at duty in their ships without necessarily losing a day by sickness. In the case of gonorrhoea, with the new sulphonamide series, treatment is now merely a matter of swallowing pills and with syphilis merely the giving of intravenous injections, and surely anyone worth the name of doctor can do this. Cases of venereal disease almost diagnose themselves, and we really do not need to insist that each case must go to a venereal disease specialist. Yet only the other day I read a letter in the B.M.J. demanding that no one but a self-styled venereal disease

specialist should be allowed to treat venereal disease. Well, let him have his way, but for mercy's sake make every naval doctor a venereal disease specialist and teach medical students something about venereal disease before they join the Services. Or, as I would prefer to put it, we specialists in marine medicine require a knowledge of venereal disease to practise our speciality, and only occasionally need the advice of a consultant in the subject.

It is therefore to be regretted that many lazy, or untaught, naval surgeons make any excuse to send their venereal disease cases to hospital, or to place them under the care of the venereal disease specialists, and I am distressed to observe that the amount of hospitalization of venereal patients is increasing. In this respect, the introduction of 'labelled' venereal disease specialists into the Navy was a retrograde step, because it has caused far more patients to be sent to the specialists in our hospitals than need be. Before the introduction of the sulphonamides, the recorded mean duration of sickness in the yearly official health returns for gonorrhœa was about eighteen days in the Navy against fifty days in the Army. Of course, the Navy took just as long to cure their gonorrhœa patients as the Army, but most cases in the Navy were treated at duty, while in the Army they were invariably sent to hospital. The eighteen days therefore really refers to days off duty, not to days under treatment. Hence, although the incidence of venereal disease in the Navy was almost twice as great as the incidence in the Army, the loss of man-power caused by venereal disease was considerably less in the Navy.

Treatment at duty is moreover good treatment, as it largely prevents the depression, loss of fitness and feelings of ostracism that are caused by the hospitalization of men suffering from venereal disease. Always in a fighting service it is total days off duty, rather than total number of cases, that count.

The licensed house under alleged medical supervision has proved more a menace than a safeguard against gonorrhœa owing to the impossibility of keeping women free from gonorrhœa or curing them of the disease or even diagnosing the disorder when present. Up to now so-called medical inspection of prostitutes is mere eye-wash. But if penicillin fulfils its promise it may be feasible to keep prostitutes 100% clean, with very little supervision. If this were true, speaking merely as a doctor interested in reducing the amount of venereal disease in the Navy, the prophylactic value of licensing the prostitutes and brothels in seaports would have to be reassessed.

# PREVENTION OF VENEREAL DISEASE IN THE AMERICAN SERVICES (1)

COLONEL PAUL PADGET M.C., U.S. ARMY

*Veneral Disease Control Officer E.T.O. U.S.A*

In the effort to reduce the loss of military manpower from the venereal diseases an ounce of prevention is worth a pound of cure. Improvements in treatment techniques have reduced the loss occasioned by each infection but prevention still remains the method of choice. Preventive methods are more conservative of manpower than the best refinements of treatment which we now have or can reasonably anticipate.

In venereal disease control there is no fixed program which may be laid on everywhere without modification. There are basic principles, however, and success will be determined largely by the skill with which each is exploited.

There is time here only for listing the categories into which control methods may be classified.

(1) *Epidemiology* or, more simply, fact finding. The facts which are necessary are

- (a) The incidence of the various venereal diseases.
- (b) Their distribution in the population under consideration.
- (c) The foci from which infection is being spread.
- (d) The success or failure of control methods.

(2) An *educational program* provides the backbone of control efforts within the service itself. This should be varied to suit the needs of the group, should be factual and should avoid either moralizing or the scare approach. Full attention should be given to the basic principles of sex hygiene, simple descriptions of the venereal diseases, correction of prevalent misconceptions, the techniques of protective measures and the use of protective devices.

(3) Detection and amelioration of the *psychological factors* which contribute to venereal exposure is a useful but little used approach. These are multiple and complex but there are three simple ones which are of major importance: (1) Boredom, (2) the state of being 'browned off' or 'fed up' and (3) the 'last fling' attitude.

Relief of boredom may call for a high order of ingenuity and much hard work, especially when the situation is limited. The state of being 'fed up' can often be improved by better relationships between commanders and troops, encouraging each to understand the problems of the other. The 'last fling' attitude is easier to prevent than it is to deal with, but common sense, facts and deglamorization of war go a long way.

(4) *Command control* is next for consideration. In the U.S. Army, at least, all of the activities discussed above are responsibilities of command, but may be delegated. Here I refer specifically to the more direct exercise of the command function, which can make numerous contributions to the reduction of venereal infections. The most important of these is leadership by example. Additional measures include such relatively unrelated factors as the selection of sites for bivouac where choice is feasible, control of pass and furlough privileges, and the judicious use of the off-limits authority.

The subject of command control cannot be left without reference to the uselessness of punishment as a preventive measure. All of the evidence is that fear of punishment for acquiring a venereal disease does not prevent venereal infection and has the vicious effect of inducing attempts at concealment of infection.

(5) Provision of *preventive materials and facilities* is one of the most tangible of the various activities, and so tends to be given undue emphasis in discussions. Materials, techniques, and procedures are well known, and are being constantly improved, and it should suffice here to say that they should be the most effective agents procurable, should be readily available, and all should be instructed in their use.

(6) Finally, a venereal disease control program for military force must include effective *control measures among the contact population*.

With a force in training in its own country this can be accomplished by an arrangement such as the 7-point agreement between the Surgeons General of the United States Army, Navy, and Public Health Service. When a force is quartered outside of its own country the problem is made more difficult. It may be solved by working arrangements, such as those between the United States Army and the British people, but these will not necessarily obtain in the next area to which we go. It is obvious that to avoid disaster it will be necessary to develop control activities with a high order of integration between military and civilian authorities. It is hoped that those in charge of planning civilian administration will undertake this problem. If they do not it may become necessary for the Armies themselves to conduct a venereal disease control program among the civilian populations.

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# PREVENTION OF VENEREAL DISEASE IN THE AMERICAN SERVICES (2)

MAJOR C. J. RADEMACHER, M.C., U.S. ARMY

During the past year I have been the surgeon with a tank destroyer battalion in North Africa and Italy. The organization consisted of approximately one thousand men and officers. My discussion of venereal disease control is almost exclusively concerned with this organization on its trek from Casablanca to combat in Tunisia, and a summer of desert training Algeria followed by five long weeks in Italy. Our problems were undoubtedly similar to the problems of the average troops.

When we arrived in North Africa in January, 1943 the white people there were skeptical of our intentions the Arabs apprehensive as to how the change might affect them. Families were comparatively intact, in contrast to many other portions of the world. Our troops saw little home life because of the reticence of the people and language difficulties. A soldier with a girl on his arm was the exception to the rule. Prostitution existed white, Arab and colored. A high percentage of the Arab prostitutes were infected with syphilis. The others had the usual run of venereal diseases, with variations. Early in the campaign houses of prostitution were declared off limits to troops. However camp followers were numerous and ingenious so that one way or another the soldiers ended up exposed to venereal disease.

The problems of venereal disease control in North Africa were essentially the same as those almost anywhere else.

Briefly as we viewed the problem there are two main methods of reducing venereal disease: (1) Reducing the number of contacts (2) Lessening the transmission of disease per 1 000 contacts.

In both the educational program and the command orders we attempted to accomplish these objectives.

In this organization the problem in North Africa was not too great. The officers and men were sincere in their attempt to keep venereal disease at a minimum. In over ten months we had but three cases of gonorrhea, but one of chancroid, no syphilis and a few simple venereal ulcers. Our program consisted of (1) Education (2) Isolation both of cases and contacts (3) Work, recreation (4) Prophylaxis.

The educational program was continuous using posters, pamphlets, lectures, training films, warnings and the like. Special attention was given to the monthly venereal lectures. These can be more detrimental than helpful in venereal disease control if not given properly. We tried to make them interesting, practical, and forceful. A line officer, a chaplain, and a medical officer usually spoke, a different group being



(4) *Command control* is next for consideration. In the U S Army, at least, all of the activities discussed above are responsibilities of command, but may be delegated. Here I refer specifically to the more direct exercise of the command function, which can make numerous contributions to the reduction of venereal infections. The most important of these is leadership by example. Additional measures include such relatively unrelated factors as the selection of sites for bivouac where choice is feasible, control of pass and furlough privileges, and the judicious use of the off-limits authority.

The subject of command control cannot be left without reference to the uselessness of punishment as a preventive measure. All of the evidence is that fear of punishment for acquiring a venereal disease does not prevent venereal infection and has the vicious effect of inducing attempts at concealment of infection.

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Discussion of venereal disease control methods in contact populations inevitably brings up the question of the usefulness of the integration and licensure of prostitution. Many of our commanders, sometimes in collusion with the civilian authorities, sometimes contrary to professional advice, tolerate prostitution presumably for the control of and amelioration of social problems among the troops. It is true that the most recent of these attempts was the one in the Philippines, but the ones uniformly have been and there still is good reason to believe that licensed prostitution is a very poor method of reducing venereal infections.

What were our results? I am inclined to feel that the educational program was successful. In spite of the prevalence of syphilis amongst the Arab population no cases developed in this command. I know that very few condoms were used compared with the number of prophylactics given because I bought the condoms and the first sergeant had them always available.

I came into the Army very sceptical of the value of the chemical prophylaxis. However I am now convinced that it is almost 100% effective granted the prophylaxis is thoroughly given by well trained medical personnel and the soldier is sober enough to co-operate. Among all the contacts followed by prophylaxis only one case of venereal disease developed and in that case the man was very drunk. I stress that even medical soldiers should be taught to give a prophylaxis.

That essentially covers the situation in North Africa. The problems multiplied and were much more difficult across the Mediterranean. The same measures were not nearly as effective in Italy where we had cases of syphilis, gonorrhea, and chancroid. The picture in Italy was different in many other respects. The civilian population was demoralized, homes were broken up and women were hungry. The soldiers were at a peak of training ready to throw all into the next battle expected very soon. They had that last fling attitude highly developed.

The result was that many who went on pass to see the sights and to drink ended up drinking in a house of prostitution or a home, and came away with a venereal disease.

In Africa the women were afraid of the soldiers in Italy decidedly not. In Africa the men protected their women in Italy many procured for them.

As I review my experiences I wonder just what I have learned, certainly nothing new and startling. There are a few points that seem important to stress. We must impress upon the soldiers the seriousness of venereal disease in contradiction to many popular writers. There should be an educational and recreational program instituted to avoid this last fling before combat. Repeatedly instruct not to drink and indulge in sexual intercourse. In general make the venereal lectures practical and interesting and real instruction.

The command should provide facilities for diversified sports and interesting recreation in leisure time. Prophylactic stations must be easily available. It is advisable to furnish condoms. Other command functions of urgency are the isolation and treatment of infected prostitutes and the abolition of procuring by any means necessary.

In conclusion, it seems that while there is no ideal or popular solution to the problem the answer can be found only in sincere, clever anticipatory planning.

employed each month to lend variety of ideas and presentation and a new approach to the subject. The officers preferably should be known and respected by the men. The line officer stressed the effect of loss of valuable training time to the individual, the organization, and the allied cause. He emphasized also the fact that drink and sexual relations should not be mixed. He also advised the use of a rubber (condom) and then plenty of soap and water and the chemical prophylaxis at the earliest opportunity. This talk was given in a strictly man-to-man fashion.

The chaplains I have heard have been excellent speakers and did a good job of it. The chaplain, as well as the medical officer, can present the unavoidable self-recriminations that follow sexual abuses. This knowledge will deter a certain number. He is the one to 'sell' to the men the integrity of our forces, and to efface what might be called the 'last fling attitude'.

The medical officer presents the medical facts and the rationale and use of prophylactics. Many varied approaches may be made. Often these talks were given in conjunction with a sex hygiene training film. These conferences give an opportunity to keep the men informed on new developments and should not become routine or uninteresting, and certainly not be an excuse for a dirty story hour. The medical officer has to show the soldiers that venereal disease is still a serious personal hazard.

Further education and direction included the following. Each time the battalion moved the men were given pertinent data on: (1) Prevalence of disease in the area, and (2) location of prophylactic stations.

The problem of isolation of cases was simple. Isolation of an individual in a shelter tent on the desert is an easy procedure, and passes were not issued until cure was assured. Isolation and treatment of contacts was not in my sphere, but I recognized it in North Africa as an almost unsurmountable problem.

So much for the educational program. There are many other measures that may be instituted to cut down the incidence and number of contacts. Plenty of work and good recreational facilities undoubtedly are important factors in this program.

During the period of training in the summer of 1943 between the African and Italian campaigns many of the contacts were in houses of prostitution. A military police patrol attempted to keep the obviously drunk from the red-light districts. A prophylactic station was established near those areas. Our men were allowed on pass (usually 15% were allowed on pass one day a week); it was really seven weeks between pass days for each man. That in itself was necessarily a method of control for it reduced the number of contacts. The reason for the low percentage of passes was the small size of towns and limited recreational facilities in them.

because loss of proficiency pay would have given the show away to their wives. Venereologists interpret the regulations concerning pay stoppages very leniently and the patient always gets the benefit of the doubt. Men contracting venereal disease from their wives suffer no penalties.

5. *Actual prophylaxis* - At home every unit is instructed to provide an ablution room where a man can wash himself thoroughly and where he can obtain a prophylactic packet containing antiseptic mercurial cream, cotton wool and soft soap. The men are told about these facilities, and how to use them, at the periodic lectures. Some unit commanding officers allow the provision of condoms, but this is a local matter and unfortunately is not widespread. I always suggest this to medical officers when speaking to them about venereal disease.

Overseas, apart from ablution facilities in units, there are special centres set up usually in brothel areas, where prophylaxis can be carried out under the care of medical orderlies. Condoms are provided free in all units overseas. Control of brothels and their inmates is also undertaken overseas.

6. *Treatment of established cases* - The treatment of syphilis in Britain is entirely in the hands of the specialists in venereal diseases. Gonorrhoea is mainly treated in camp reception stations, but only if uncomplicated. Patients with venereal disease are always isolated until they are non-contagious. Patients who default from anti-syphilitic treatment are always pursued with the greatest insistence and the default rate is naturally much less in a disciplined population than in civil life.

7. *Contacts* - If there is no control of the sources of infection it is unlikely that prophylactic measures can do very much to reduce the incidence of venereal diseases. Overseas, the compulsory treatment of brothel inmates is possible. Here at home the problem is more difficult. Regulation 33B aims at the habitual spreader of venereal disease. I think that the Army venereologists have done more than anyone to provide the public health authorities with notification of infected persons. The administration of this regulation varies greatly in different parts of the country but in those areas where it is widely interpreted, i.e. where some action is taken on a single notification a great deal of good has been done.

Quite apart from this, when a man is well acquainted with the woman who gave him the disease, it has always been the practice of army venereologists to get him to send a letter to the woman advising her to see a specialist. A note is enclosed for her to give to the specialist advising him of the disease suspected. Over 25% of women so notified go voluntarily for examination.

I am fortunate in being able to run a weekly clinic for civilian women whom I have traced in this way. Most of the women who attend are the wives of my soldier patients. Sometimes the wife has infected

## PREVENTION OF VENEREAL DISEASE IN THE BRITISH ARMY

LIEUTENANT-COLONEL JAMES MARSHALL, R.A.M.C.

*Command Venereologist Eastern Command and London District*

The policy of the British Army in the attempt to prevent and control venereal disease may be summarized as follows

1. *Propaganda* - (a) *Lectures*. - Lectures on venereal diseases are given by unit medical officers at regular intervals. The general substance of the lecture is laid down in a pamphlet, but the medical officer is at liberty, and is encouraged, to change the mode of presentation to suit his audience. Briefly, men are advised that the only sure way to avoid infection is by complete abstinence, but if a risk is taken there are means by which the possibility of infection can be reduced. A check is kept by venereologists to make sure that men are being adequately lectured and that prophylactic facilities are being provided by units. (b) *Films* are also used. At home the films used, e.g. 'Subject for Discussion,' are confined to non-controversial subjects. Overseas, however, troops are shown films on the actual technique of preventive hygiene measures.

2. *Welfare*. - Provision of good recreational facilities is important in keeping men occupied in their spare time, and every effort is made to have good canteens, clubs, and welfare centres, as easily available as is possible.

3. *Leave*. - British troops at home have a week's leave every three months and a short pass between leaves. If a man is near his home it is the rule for him to be allowed at least a night at home each week and, if his work permits it, to have permission to sleep at his home when he is not on full-time duty. The bulk of venereal disease in married men occurs in those stationed a long way from home.

4. *Penalties*. - It is no crime in the Army to contract a venereal disease, but it is a crime to conceal it. A man in hospital suffering from a venereal disease loses 1s. 6d. a day in hospital charges so long as he is in hospital because he is suffering from a disease due to his own fault. He may also lose, while in hospital, special proficiency pay in some cases. It is unfortunate that, in the case of a married man, proficiency pay has often been allotted to the wife, and she is the loser. The army medical authorities have tried, and still are trying, to have even this minor penalty removed, so that we may come in line with the other Services. (This has been accomplished since the delivery of this paper.) It is fair to say that I have only twice had cases of men concealing a venereal disease for fear of the financial penalty and then

# THE PREVENTION OF VENEREAL DISEASE

AIR COMMODORE G. L. M. McELLIGOTT

*Consultant in Venereology R.A.F.*

In 1938 the incidence of venereal disease in the R A F at home was 5.3 per 1,000 per annum compared with 24.5 per 1,000 in overseas commands. That the home incidence was so low is not surprising as here was a small well-cared for corps of artisans living under conditions where there were opportunities for sport and frequent leave at home and where early marriages with a good chance of living on or near the airman's station were encouraged. Since the war the rate has inevitably risen but not inordinately considering the vastly changed circumstances and in static commands at home such as technical training command where conditions still approximate to those of peace, this rise does not occur.

In operational training units at home, the aircrew incidence is anything up to four times that of the ground staff the reasons for this disparity are not far to seek. In wartime the flying man is constantly risking his life and is surrounded by an aura of glamour. He also has more leave, more pay and consequently more alcohol. Such a man has a less cautious attitude to life in general and *Carpe diem* is too often his motto. It is not surprising that Dominion and Allied personnel are particularly prone to infection first because they are away from home influences and secondly owing to differences of language, accent and behaviour they lack discrimination in their choice of female society. I personally feel that a good deal more could be done in the way of organized entertainment and hospitality for these men.

In operational units even those at home, ground staff show a higher rate than in non-operational ones. It is hard to know why this should be so but it is probably partly due to the standing example of the aircrews with whom they are working. In Italy, however, the ground crew rate was twice that of the aircrews. Here the latter were very busy with constant operational duties and for the most part spent their leave in attractive non-urban rest centres, where sport and other organized recreations were excellent. Ground staff on the other hand were not so well catered for and were continually in and out of near by towns on transport and other duties.

The prevention of venereal disease is largely an executive, welfare and provost problem and if these branches do not play their several parts, the efforts of the most conscientious medical officers will be unavailing.

Preventive factors in order of importance include discipline (not

the husband, but oftener the soldier has infected his wife. In the latter case the commonest history is that the man has come home on leave while incubating the disease and developed symptoms after a few days, having unwittingly infected his wife in the meantime. In the four years I have run this clinic I have found 50% of the women who attended to be infected. No woman is passed free of infection unless she has been repeatedly tested over at least three months. I have found it a great help in these cases to know both sides of the story and there is no difficulty in keeping the women attending. My annual default rate is under 10%.

*The A T S* - In the case of women no *ad hoc* venereal disease lectures are given, but the subject is discussed as part of a lecture on general health and hygiene. No prophylactic facilities are provided. Infected women are treated in military hospitals and clinics and are confined to hospitals in the early stages until they are non-contagious. The numbers of infected Service women are remarkably small considering the size of the Service. As with men, Service women have a much lower default rate under treatment than their civilian counterparts.

When a soldier says that he suspects his infection came from a Service woman there is a system whereby she is confidentially approached, usually by a woman medical officer, and is advised to submit to investigation.

#### SUMMARY

The whole edifice of prophylaxis against venereal disease collapses when it comes up against alcohol. Quite 25% of men are intoxicated when they contract venereal disease and at least 75% have taken some drink. I believe that the lines of attack in the prevention of venereal disease are, -

1st - By educational methods, which will get at the intelligent men  
2nd - By provision of the best prophylactic facilities, and here I put the condom first in the list

3rd - By provision of the best possible treatment for infected patients - in hospital during the early stages and by specialists.

4th - By attacking the source of infection by any means available - at home by contact tracing and the use of Regulation 33B when necessary, abroad, on the same lines but with even tighter control. It is hoped that in the future regulations enforcing the continuation of treatment will be introduced. At present any civilian can default from treatment at any time and nothing can be done. Close co-operation between Service and civil authorities is required and if necessary the supervision and treatment of civilians by the allied medical authorities should be undertaken in occupied countries.

a few minutes and the glans and prepuce are promptly washed, the odds are that infection will not take place. I think there is a risk of slight chemical urethritis following the instillation of solutions of silver salts, after which at the next intercourse - and only too often there is a next one - the traumatized urethra is more easily infected.

The prevention of venereal disease is largely a moral or a morale problem with a strictly limited medical side. We, as medical officers are responsible for education and the provision of prophylactic facilities. We must explain carefully how these are to be used - how alcohol blurs discrimination and that we can never promise 100% results from even the most punctilious prophylaxis. It is also our duty to interest both senior and junior commanders in the problem of prevention and to endeavour to enlist their active help. To the commanding officer who says to the medical officer 'Too much venereal disease on the station Doc. what are you going to do about it?' the reply is obvious.

NOVEMBER 1914

## MANAGEMENT OF VENEREAL DISEASE IN A FIELD ARMY UNDER COMBAT CONDITIONS

MAJOR W. P. KILLINGSWORTH M.C. U.S. ARMY

Venereal disease can be successfully treated in Army field forces under combat conditions, thereby greatly reducing the days lost from venereal disease.

The sulfonamides are unsatisfactory for treatment of gonorrhea under combat conditions. Penicillin is the drug of choice in the treatment of gonorrhea. 90% of all cases of gonorrhea can be cured with adequate doses of this medication initially. The remaining 10% will respond likewise if proper urological study and manipulation is given. The initial dosage of penicillin should be 200,000 units. With our present form of penicillin, cases of gonorrhea treated as outlined can be returned to duty in twenty-four to forty-eight hours. A serological check-up at the end of three months of all cases of gonorrhea treated with penicillin is mandatory.

Penicillin is the drug of choice in the treatment of primary and early secondary syphilis, and is worth while also in the treatment of late secondary, new and old latent cases but should be given in conjunction with mapharsen. Penicillin rapidly renders primary syphilitic lesions non-infectious and causes rapid healing thereof. Primary and early secondary cases of syphilis can be returned to duty in from ten



forgetting self-discipline), *esprit de corps*, organization of leisure to fight boredom, the provision of welfare institutions, sports facilities and other substitutional activities. These are the responsibilities of unit commanders, welfare officers and padres. Education in the facts about venereal diseases, the effects of alcohol on self-control, methods of self-disinfection, etc., is the responsibility of the medical officer, who should be careful to explain that these methods will diminish but not make unnecessary the chance of infection. Unit commanders, however, must take an interest in their medical officers' efforts. There is sometimes a not unnatural reluctance for them to risk being dubbed preachers or hypocrites, which in fact never happens, but medical officers have often told me that a lecture with the C.O. in the chair always does 'cut ice'. I think that embryo officers at O.C.T.U.s could with advantage be instructed in the line to take on these occasions, as well as in their general responsibilities in venereal disease prevention. Though a man may not mind being unpopular with his superior officers, he will hate being so with his comrades, therefore the 'letting down the side motive' must be stressed and the man to do this is the unit commander.

Sanctions against the infected man are useless and may easily lead to concealment or illicit unskilled treatment. Units should be periodically informed of their venereal disease rate and the causes of any rise investigated without delay.

*Disinfection* - Facilities for self-disinfection must be made available and all ranks instructed in their use, but if these are located in camp or quarters, many will not take the trouble to use them after a slow trip from the nearest town where the risk is usually run. In the R.A.F. our experience is against staffed 'prophylaxis centres' on stations, as men are often shy to use them, though when these are located in the town itself, they are usually well patronized, as the anonymity of the patron is secured. These were particularly successful in towns such as Algiers and Naples, where they were set up adjacent to brothel areas.

Condoms and 'prophylactic packets' should be available and free to all. The latter are best distributed two at a time. I am emphatically against them being pressed on all. The maxim, 'never be without one' is a two-edged sword. It can easily engender a sense of false security and, like the schoolboy's half-crown, is apt to burn a hole in the pocket until it is used.

In areas where chancroid is common, such as Southern Italy, 15 to 30% sulphathiazole cream may be used prophylactically, but in combination with 33% calomel cream it will surely act as a diluent to the latter and weaken its antispinochaetal effect. Prompt forcible miction is probably still the most effective anti-gonococcal measure. The gonococcus does not walk into the urethra but is deposited at the meatus in a droplet of muco-pus, if this is mechanically expelled within

TABLE V - BREAKDOWN OF SYPHILIS CASES TREATED WITH PENICILLIN

(1) Primary	613 (72.3%)
(2) Secondary	110 (12.9%)
(3) New latent	23 (2.8%)
(4) Old latent (including relapses, inadequately treated cases)	100 (12%)
(5) Total cases treated	846

TABLE VI - VENEREAL DISEASE RATE PER 1,000 PER ANNUM FOR WHITE AND COLORED TROOPS FOR THE PERIOD

	White Troops	Colored Troops	Aggregate
July 1944	12.91	36.49	14.47
August, 1944	2.33	17.25	3.41
September 1944	12.17	105.97	16.61
October, 1944	19.51	207.00	28.75
November 1944	15.28	192.43	24.81
December 1944	12.28	105.23	16.53
January 1945	11.03	115.26	16.20
February 1945	13.80	88.32	17.12
March, 1945	11.83	74.26	15.32
April, 1945	12.43	50.93	14.25
Average for ten months	12.412	101.486	16.745

a Average mean strength white troops for ten months, 2,56,240.

b Average mean strength colored troops for ten months, 12,543.

c Average mean strength Army aggregate for ten months, 268,783.

NOVEMBER 1944

## VENEREAL DISEASE IN THE FIELD PRESENT POLICY AND MANAGEMENT IN THE BRITISH ARMY

LIEUTENANT-COLONEL DOUGLAS J. CAMPBELL, R.A.M.C.

*Adviser in Venereology 21 Army Group B.L.A.*

There are two fundamental principles in the management of venereal disease in the field (i) Adequate treatment leading to the highest possible recovery rate and (ii) the saving of manpower

The advances in the treatment of venereal diseases during the last twenty five to thirty years are amongst the most dramatic in the history of medicine. During the war of 1914-1918 gonorrhoea was a most difficult disease to cure, requiring an initial hospitalization

to twelve days. The final evaluation of the efficacy of penicillin in the treatment of syphilis must be withheld until a later date.

Chancroid cases can be returned to duty in from five to fourteen days if treated as outlined above. A simple, sensitive, specific laboratory test for chancroid is needed.

Experienced laboratory workers and good laboratory facilities are essential in every venereal disease management program.

TABLE I - VENEREAL DISEASE CASES TREATED IN THIRD U.S. ARMY FOR PERIOD JUL 1, 1944 TO MAY 1, 1945

	Cases
(1) Gonorrhea . . . . .	3,912 (80.3%)
(2) Syphilis . . . . .	846 (17.4%)
(3) Chancroid and others . . . . .	111 (2.3%)
(4) Total cases . . . . .	4,869 (100%)

TABLE II - INSTALLATIONS WHERE TREATMENT WAS RECEIVED

(1) Aid stations, unit dispensaries and clearing stations . . . . .	1,521 (31.1%)
(2) Evacuation hospitals . . . . .	1,519 (31.0%)
(3) Convalescent hospital . . . . .	1,829 (37.9%)
(4) Total cases . . . . .	4,869 (100%)

TABLE III - RESULTS IN TREATMENT OF GONORRHEA

(1) Total cures with sulfonamides . . . . .	602 (53.4%)
(2) Total failures with sulfonamides . . . . .	430 (41.6%)
(3) Total treated with sulfonamides . . . . .	1,032 (100%)
(4) Total cures with penicillin (initial treatment) . . . . .	2,629 (91.3%)
(5) Total failure with penicillin (initial treatment) . . . . .	251 (8.7%)
(6) Total treated with penicillin (include all sulf-resistant and all complicated cases) . . . . .	2,880

TABLE IV - PENICILLIN FAILURES (ONE COURSE OF TREATMENT)

(1) Strictures . . . . .	151
(2) Chronic Prostatitis and Seminal Vesiculitis . . . . .	30
(3) Non-specific urethritis . . . . .	21
(4) Chronic epididymitis . . . . .	11
(5) Narrow external urinary meatus . . . . .	11
(6) Excessively redundant prepuce . . . . .	9
(7) Accessory urethral channels (Littre glands) . . . . .	7
(8) Compertus (gonorrhea) . . . . .	6
(9) Hypospadias and epispadias . . . . .	4
(10) Congenital canals of penile raphe . . . . .	1
Total . . . . .	251

commencement of the present campaign the routine treatment in the British Army has been neo-arsphenamine and bismuth for an average initial hospitalization of fourteen days and subsequent weekly treatment for about fifty two weeks. In a field force, default under this scheme is approximately 50 %

As with gonorrhoea, which lagged behind anti-syphilis treatment for so long and then raced ahead in the sulphonamides the road in syphilis leads to penicillin at least in the early cases given as 40 000 units intramuscularly every three hours for 60 injections - a total of 2,400,000 units in seven and a half days. High cure rates apparently result and toxicity is nil. The difficult aspect is that of surveillance and ultimate assessment. We must realize that we have achieved the second principle, of saving manpower but the first of adequate treatment, awaits the verdict of the next few years.

In parallel with therapeutic advances changes have resulted in the provision of treatment facilities in the Army. During the last war it was essential to hospitalize all cases of gonorrhoea for an average of 28.6 days and syphilis for 37.6 days. During the ensuing peace all cases of venereal disease in the Army were hospitalized and this practice continued in the early period of this war until the two days sulphathiazole therapy for gonorrhoea was introduced. In unit lines or Duty status. The campaigns in Middle East and North Africa were characterized by rapidity of movement with long lines of communication and resulting delay in providing hospital accommodation for venereal disease cases forward. In the desert war this was probably not serious as the forward area was sparsely populated and even in North Africa incidence was low in the advancing Army but, once Sicily and Italy were invaded, with a terrific increase in incidence and a sudden failure of sulphathiazole therapy in gonorrhoea, a large problem arose when soldiers had to be evacuated over the Mediterranean for treatment. To meet the problem venereal disease treatment centres were formed, one type to cope with 100 and the other with 200 cases. The establishments were 2 officers and 16 other ranks for the first and 3 officers and 28 other ranks for the second. They were entirely dependent on field medical units. These venereal disease treatment centres did good work on both sides of the Apennines in Italy.

When 21 Army Group embarked on the invasion of Western Europe the following scheme was outlined. gonorrhoea would be treated forward with 20 gm of sulphathiazole in four days. In operational troops cases would be admitted to divisional medical units. Failures would be referred at once to venereologists for penicillin therapy without local treatment, instrumentation and fever therapy and their concomitant hazards. All cases of suspected syphilis would be referred to the nearest venereologist for diagnosis. The continuation treatment of syphilis with neo-arsphenamine and bismuth would be carried out at various field medical units, field ambulances, field dressing stations

averaging 28.6 days and it had a relapse rate of approximately 20%.

Venercologists started this war better armed than ever before with sulphapyridine which gave an average hospitalization for gonorrhœa of eight to nine days, and the further appearance of sulphathiazole and sulphadiazine gave even greater cure rates and lower incidence of toxic manifestations. In the quest for short adequate courses of sulphathiazole therapy there was gradually evolved, in 1943, a two days' treatment 'In unit lines' in which the drug was given in a dosage of 5 gm for each of two days. Cure was claimed in 90% of cases of uncomplicated gonorrhœa but, in the experience of most, a 70 to 75% recovery rate was actually achieved.

During the North Africa Campaign, when reinforcements had to be carried such long distances to the theatre, this further method of conserving manpower, transport and hospital accommodation was well worth the organization which had enveloped nearly all medical officers in the treatment of gonorrhœa.

The invasion of Europe through Sicily and Italy brought to light a type of gonorrhœa of great virulence which did not respond to sulphonamides, and long hospitalization again became necessary with the employment of pre-war adjuvant methods. Gonorrhœa had again become a leading health problem, along with malaria, and the greatest cause of lost man-days.

Since the campaign in Western Europe commenced geographical and tactical conditions kept the incidence low in the early stages, but now the populous places are being occupied gonorrhœa is more prevalent. Already there are a number of cases which are not reacting to sulphathiazole, even though, in view of the experience in Southern Europe, the initial course has been extended to 20 gm in four days. In my opinion four to five day therapy has always given the highest recovery rate.

Although the last two years brought rapidly increasing gloom, reaching fearful depths in Italy, penicillin has revived our hopes and again we talk in terms of more than 90% success. So far penicillin used initially or after failure of four days' sulphathiazole therapy has given amazing results. In British cases in 21 Army Group penicillin has been administered to 211 initial failures with sulphathiazole and to 98 cases which relapsed within a week of apparent cure with sulphathiazole. Only 3 of these 309 cases were not cured by 100,000 units of penicillin, and each recovered on a further course. Furthermore, stay in a medical unit is less than forty-eight hours.

No less dramatic is the progress in anti-syphilitic treatment in the last thirty years.

In the search for short intensive therapy the most accepted now is the twenty-day course of mapharside giving 20 mg per kilo of body weight. Even with this, skilled supervision and nursing are essential since encephalopathy and grave leucopenia may result. Up to the

deavouring to prevent default from treatment or surveillance breaks down when the Army increases to war capacity and is campaigning over vast distances. Security alone precludes widespread publication of locations and follow up becomes lengthy if not impossible. To overcome this problem a central register has been established at 21 Army Group Headquarters to which all cases of syphilis are reported as well as their subsequent treatment and surveillance, no matter which venereologist carries this out. If there is a delay in receiving this periodic report default is assumed and inquiries instituted by this headquarters, thus valuable data will be collected and the standard of cure will be under constant review.

Mention has been made earlier of unsatisfactory hospitalization and resulting decline in morale which is sometimes attained. Many have considered punitive measures and hardships necessary as part of the cure, but modern psychological elucidation of the factors which make men run risks, especially abroad, has taught us that it is a great mistake to reduce further a soldier's efficiency. With this in mind 21 Army Group has made vigorous attempts to restore rather than diminish soldier's morale and by the abolition of the leper attitude and the adoption of other methods of rehabilitation, men are more rapidly restored to usefulness.

NOVEMBER 1944

## VENEREAL DISEASE IN THE FIELD PRESENT POLICY AND MANAGEMENT IN THE ROYAL AIR FORCE

AIR COMMODORE G. L. M. McELLIGOTT

*Consultant in Venereology Royal Air Force*

In spite of the speed of modern treatment, venereal diseases are still the greatest single cause of temporary non-effectiveness in campaigns such as the present one in the Low Countries, where the country is densely populated and where the population is overjoyed at its rapid liberation.

*Brothels* are out of bounds to all ranks in all theatres. I am convinced that the ambulant prostitute is less of a danger than her sister in the brothel, who can, and often does, take on as many as thirty or more men in the twenty four hours.

*Protection packets* are available free for all at sick quarters or the guard room.

*Disinfection centres* are available on all R.A.F. stations both at home

and casualty clearing stations, the medical officers of which had received instruction in intravenous neo-arsphenamine therapy under command venereologists in United Kingdom before 'D-Day.' The personal card Army Form I 1247B, carried by the soldier, was sufficient introduction to obtain the routine treatment in the course of his movements. At the commencement of each course a review would be made by a venereologist, a blood test taken and further treatment outlined. Across France and Belgium default rate was high.

Penicillin is now the drug of choice in early syphilis

Tests of cure for gonorrhœa, chancroid and other non-specific conditions would be carried out by a venereologist at three months and include a blood test to exclude syphilis. In cases of gonorrhœa which have received penicillin a further blood test at six months is carried out in case incubating syphilis has been partially aborted

As regards disposal of treatment facilities we have decided in Army areas to employ venereal disease treatment centres forward, one for each corps and one for Army troops. The present establishment consists of 1 venereologist and another medical officer, who is preferably a trainee in venereology, 1 sergeant, 1 corporal and 4 private special treatment orderlies, 1 clerk, 2 general duty orderlies and 1 cook—virtually the personnel to run a 100-bedded expansion of a general hospital. Each unit is equipped with medical equipment on the scale of Appendix 'E' of Army Form I 1248, weighing 5 cwt., so that, apart from serological tests, full diagnosis and treatment of venereal conditions can be carried out. A modified general equipment scale (G 1008) for accommodating 25 cases in bed, and 75 or more on stretchers or palliasses could be carried if transport were available. Such units can well treat cases under good field hospital conditions for periods up to three weeks and so prevent the loss of men from the corps areas with the resulting slow return to units via reinforcement holding units

These venereal disease treatment centres have been attached to field dressing stations or casualty clearing stations. In the Mediterranean such attachments virtually flooded the field medical unit, but in 21 Army Group, with the employment of penicillin on the lines indicated, the parent units can fulfil at least part of their intended function and in several instances field dressing stations have worked very well as venereal disease treatment centres and exhaustion centres. In the line of communication area it has been most convenient to place venereologists with their staffs and equipment at general hospitals. The essential character of this arrangement is that personnel and equipment should be readily mobile as the battle advances or more populous base or transit areas are occupied in the line of communication.

It has long been apparent that some central control of venereal disease, especially syphilis, should be exercised in wartime. The system of all treatment centres keeping a syphilis register and en-

follow up leading to proof of cure is easily the most responsible part of the whole business, and calls for painstaking co-operation between the unit medical officer the specialist and the pathologist. Early syphilis is followed for two years and in addition to frequent blood tests the spinal fluid is examined at the sixth and twenty fourth months. The most important part of the follow up of gonorrhoea is the frequent and careful examination of the apparently cured patient and his morning urine by the unit medical officer. Orthodox tests of cure are carried out at the third month, and include examination of the prostatic secretion and massage of the urethra on curved sounds.

Careful diagnosis and follow up with good pathological facilities are the essential factors in the management of venereal disease in the field. Treatment depends almost entirely on the efficiency of well drilled conscientious medical officers and nursing orderlies.



and abroad, but I am not convinced that they have any appreciable effect in preventing disease. The staffed army centres in large towns are probably more efficacious, as men can use them very soon after running a risk of infection. Prophylactic sulphonamide treatment is never given and I do not advise its use. There is always a danger of sensitization, which may easily be disastrous if the drug is given later for some more serious illness. Gonorrhœa is now easily treated with penicillin.

*Diagnosis* – All suspects are sent for diagnosis and treatment to the nearest R A F mobile or general hospital or, when one of these is not adjacent, to the nearest Army venereal disease centre. In the Low Countries, where the mobile field hospital is located centrally in each group, roads are good and distances are comparatively short. A medical officer of considerable professional seniority, who has attended a course of instruction on the subject, is in charge of the venereal disease department and is assisted by trained orderlies. Hospital routine ensures that medication is regular and that careful documentation, the key to a proper follow-up, is carried out. A microscope, with dark field illumination, is available and the blood is sent to the nearest general hospital or mobile laboratory for examination. In isolated localities Kahn tests are done by trained personnel at the medical field hospital. Medical officers at these mobile hospitals know their limitations and if there is any doubt about diagnosis, especially of primary syphilis, they refer the case to a venereal disease specialist for his opinion.

*Treatment* – Gonorrhœa is treated with 150,000 units of penicillin (30,000 units three-hourly) and the patient is discharged to duty and observation of his unit medical officer after forty-eight hours. This dosage does not appear to mask concurrent incubating syphilis, but to ensure that this does not occur, Kahn tests are carried out three and six months after treatment. It is sometimes justifiable to treat gonorrhœa in station sick quarters. Before treatment is commenced the slide is sent to the nearest hospital or laboratory for examination. In this case the unit medical officer must be in close touch with his pathologist and there should be satisfactory refrigeration, especially in the tropics, for storage of penicillin.

Non-specific urethritis is a common condition and is unaffected by sulphonamides and penicillin. Consequently it is not justifiable to treat all cases of undiagnosed urethritis with the latter and hope for the best.

Early syphilis is treated with 2,400,000 units of penicillin (40,000 units three-hourly). We cannot pretend that the last word has been spoken on optimum time-dose relationship, and in selected centres we are experimenting with different schemes of treatment.

Given adequate supplies of penicillin, the treatment of nearly all cases of gonorrhœa and early syphilis should give no trouble. Careful

## SECTION VII

### Active Operations

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## THE MEDICAL SERVICES AND EXPERIENCES OF THE ABYSSINIAN CAMPAIGN, 1940-41

MAJOR-GENERAL R. E. BARNESLEY C.B., M.C., R.N.S.

*Late D.M.S., East Africa D.D. M.S., Southern Command*

It would be futile for me to attempt to cram within the compass of a twenty minute talk anything like the full story of what must surely be the swiftest and one of the most dramatic campaigns in the history of British Arms. All I can hope to do is to give a skeleton outline of the campaign and a very short review of the constitution and working of the medical services.

In 1939 the British troops in the Territories amounted to little more than two infantry brigades with little or nothing in the way of artillery or other supporting troops and with no military medical service. On the declaration of war however a considerable expansion was taking place from local resources. Early in 1940 our exiguous medical service consisted of three independent field ambulance companies, three small 100-bedded casualty clearing stations, three small motor ambulance convoys each consisting of twenty-seven vehicles in varying stages of decrepitude and little else. We had no general hospitals. There were no R.A.M.C. units and in fact only two R.A.M.C. officers in the force and the whole organization was improvised from the Colonial Medical Service. It must be remembered that at this time the entry of Italy into the war was, to put it mildly, very problematical and the Colonial Governments naturally showed some reluctance to denude their hard worked medical service to provide for a war which might never occur.

When, therefore, Mussolini decided to play the jackal's part the medical situation was precarious. Detachments were scattered for a distance of up to 400 miles from our headquarters at Nairobi, separated by a waterless desert which became quite impassable during the rainy season.

Our C.C.S.s were anchored in the area around Nairobi acting as general hospitals and air evacuation was limited to the occasional emergency.

During the anxious months of early 1940 the force was gradually being built up. Two brigades each with its field ambulance, came from Nigeria and the Gold Coast and troopships steamed into Mombasa and transport came rolling north through Broken Hill, carrying the South African Forces, and finally when the South African Air Force roared over Nairobi hopes began to run high.

On the medical side, our units came from Kenya, Uganda,



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office at rear headquarters in Nairobi whence, from time to time he would sail forth by air and descend from the clouds with uncanny intuition when our organization was almost stretched to breaking point, bringing with him the glad news of reinforcements on the way. This rear headquarters administered base installations, hospitals, hospital ships, hospital trains, statistics etc. General Cunningham himself accompanied advanced headquarters, which roughly fulfilled the role of a corps headquarters administering two divisions - 11th and 12th East African divisions.

The staff however fell far short of corps headquarters standards. Fully anticipating a return to Nairobi within a fortnight, the D D M.S. hurriedly boarded a 15-cwt lorry with two clerks, a stationery box, a message pad and a diminutive African boy who acted as office boy, batman, messenger and policeman combined.

Medical units had no wireless of their own and as distances increased the strain on the signal services became tremendous. As the attacking brigades advanced, sometimes 50 miles a day, the position of the D D M.S. became more and more difficult. If he remained with the main advanced headquarters divisions might get 100 miles or so ahead and the A.D.M.S. be left in the air with no medical support behind him; if on the other hand, he went with the advanced element of advanced headquarters it meant that he would land by air on a recently captured airfield without transport and with little chance of making personal contact with the medical detachments strung out along the road and it was thus impossible for him to get first hand knowledge of the difficulties with which they were contending.

A solution was found by the unorthodox method of moving the medical headquarters as a kind of independent unit which moved a day or two in advance of main advanced headquarters and by a lucky chance was generally able to make contact with the Divisional A.D.M.S. just as he was packing up to leave.

As usual the field ambulance formed the keystone in our evacuation scheme. The 10th South African Field Ambulance which accompanied the South African Brigade, was a large unit consisting of three fully equipped companies each capable of forming a main dressing station. It possessed a surgical team and had twenty-eight motor ambulances and the brigade thus may almost be said to have carried its own C.C.S. and M.A.C. along with it.

The remaining field ambulances from Kenya, Uganda, Tanganyika, Zanzibar, the Gold Coast and Nigeria were on a headquarters and two company basis. The territorial nature of these units prevented any system of 'leap frogging'. Difference of colour, race, language and custom stood in the way of this; in fact many of the Kenya boys could only be persuaded with difficulty that in the event of a breakdown of supplies, they would not be served up as rations for the cannibals of the Gold Coast!



Tanganyika, Zanzibar, Northern Rhodesia, Nyassaland, Southern Rhodesia and the Belgian Congo. Each of these came under an entirely separate and distinct Government so that administration was not easy and only those who know the habits of Colonial Governments can have any idea of the mass of correspondence which descended upon us if an askari broke his glasses or trod on his false teeth and we had to get a decision on the weighty question of 'who pays and how much'.

Early in March, 1940, the Director-General of the South African Army Medical Corps visited Nairobi and he recommended to the Prime Minister that this magnificent service should not only look after South African troops but should also fill in the gaps in the whole East African medical organization. From the date when he arrived and took charge in person, our troubles began to disappear.

On October 29, in the gathering dusk, a silver Lockheed Lodestar touched down on Nairobi carrying Field-Marshal Smuts and our new commander, General Cunningham. After a few weeks had elapsed, we were told that our troops were to make closer touch with the enemy. These troops were strung out on a seven-hundred mile front from Lokitaung to Mombasa. Until the last moment, nobody could be informed where or when the thrust would be made until, early in 1941, with only two or three days' warning, it was revealed that General Cunningham had decided to march on Kismayo.

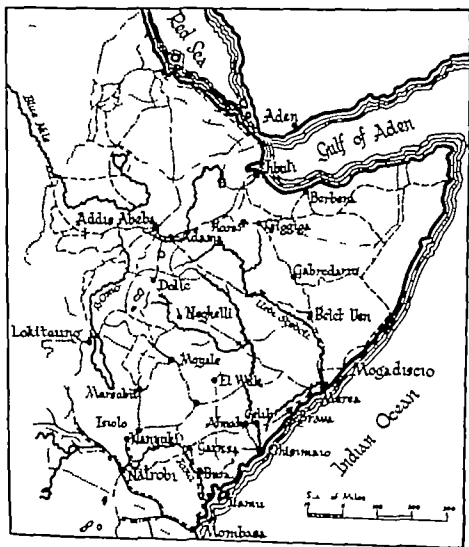
The vexed question which formed the subject of many conferences was 'Could we take Kismayo and establish a line on the Juba and thus receive supplies by sea before the impending rains came and destroyed our communications?' By the time the rains actually arrived the force had advanced over a thousand miles and the pipers of the Transvaal Scottish had led a triumphant army through the streets of Addis Ababa.

Time will not permit of any description of the operations whereby Kismayo was taken on February 14, Mogadiscio, three hundred miles farther on, eleven days later on February 25, Harar, 600 miles farther still, on March 27, and finally Addis Ababa on April 6. You can imagine the many problems and difficulties inherent in a phenomenal advance of this kind with troops moving night and day over unspeakable roads, littered with thousands of burnt-out vehicles and encumbered with nearly 100,000 prisoners anxious to give themselves up and reach a safer haven of British territory. Apart altogether from the normal stress of battle, I have vivid recollections of our transport drivers, tired almost to exhaustion, axle-deep in a sea of blinding red sand, often only able to breathe with the aid of their respirators and with a range of visibility comparable to that of the thickest London 'pea soup'.

It remains now to give a short description of our medical organization. The Director of Medical Services, Brigadier Orenstein, had his

an ignorance of map reading or car maintenance might cost them their lives from starvation thirst, or heatstroke and they would tackle anything from a native rising to a retained placenta with equal zest. I should like, therefore, to pay a final tribute to all the men and women of the medical services and not the least to the devoted and gallant work of the native personnel snatched from the wards and laboratories of Nairobi or Dar-es-Salaam and plunged into a little-understood white man's quarrel in a wild and inhospitable land.

If you ask me to epitomize the whole campaign in a single sentence, remembering that an army of some 200,000 to 250,000 had been chased nearly 1,200 miles and almost entirely destroyed in the space of two months by two divisions, I would adapt Mr Churchill's historic statement and say Surely never in the story of human conflict have so many run away so fast and so far from so few



The long distances and appalling roads prevented evacuation by road to the rear and we followed the very unorthodox system of banking on the success of every bound forward and bringing our casualties with us until they could be evacuated by sea from Kisimayo, Mogadiscio and later Berber.

The motor ambulance convoy worked on more or less orthodox lines. The medical wing of this unit performed an especially useful part and on more than one occasion acted as a small advanced dressing station. The casualty clearing station, cursed by the usual difficulties in obtaining transport, played a vital part, especially after we had turned inland from Mogadiscio. In spite of many vicissitudes and innumerable difficulties, these units followed us, faint but pursuing, and never failed to maintain contact.

The hygiene section was an especially useful unit and was always very far forward. In fact, on one occasion the section was tearing along at a very rapid rate when a curious sense of detachment came over the C.O. and he decided to pull in on the side of the road for a 'breather.' A few moments later, tanks and armoured cars came looming through the dust and when he had finally ascertained from the vanguard commander to which side he belonged, he learned that, for the first time in military history, a hygiene section had formed the spearhead of the British attack!

Air evacuation was limited to the not infrequent occasions when patients were left in small posts out in the blue, which were inaccessible to other forms of transport. Organized air evacuations on a large scale did not take place as air supplies to troops were a great rarity in those days. We had, however, two ancient Valentias and a Fokker lent us by the Belgians which did yeoman service.

We were rather proud of another unit which was our own invention and was known as a mobile malaria section. It was a kind of malarial reconnaissance unit which went forward, sometimes even in advance of our foremost troops. It consisted mainly of extremely knowledgeable and quite unmilitary young men, who would suddenly appear in the most outlandish places, in a lorry looking like a gypsy caravan, bringing with them most complete and accurate entomological surveys of the terrain to be occupied by our troops.

I hope that even this very short and incomplete survey may have made it clear that our chief problem was to preserve the continuity of the medical organization. Once this had broken down, disaster would surely have followed.

It was the superb team work of our medical personnel which prevented such a breakdown. If an officer once 'sat down and waited for orders' he was undone and every hour of the twenty-four it was necessary for him to maintain contact by hook or by crook.

The men of the Colonial Medical Service were ideally suited for the work. In the normal course of their peacetime duties they knew that



## CLOTHING FOR WAR IN ARCTIC CLIMATES. EXPERIENCES IN ICELAND

COLONEL F. A. BEARN, C.B.E., D.S.O., M.C.

*A.D.M.S., 52nd Division*

In devising clothing suitable for campaigning in arctic or sub-arctic climates it is important to bear in mind certain elementary principles

(1) Clothing does not in itself confer warmth, it prevents heat loss from the body.

(2) It does this not by virtue of weight or thickness but by interposing between the body and the outside air a layer or layers of non-conducting dry stable air, and woollen clothing is best because it encloses air between its fibres

(3) If sweating occurs these layers of air become moisture-laden and so better conductors of heat and it must be possible easily to get rid of this moist air if sweating does occur

These principles were embodied in what is known as the Brynje system which, when intelligently applied, gave warmth and comfort without weight. The actual garments used were as follows

(1) A string vest. - This vest was composed of a wide-meshed garment shaped like an ordinary vest and made of moderate gauge string. It reached from the neck to the loins and was worn next to the skin, thus holding a thick layer of warm air between the body and the next layer of clothing

(2) The ordinary Army issue of woollen shirt without collar.

(3) The ordinary Army issue of woollen jersey.

(4) A heavy woollen jersey - This is not normally worn when on the move but as will be explained later is most useful at a halt.

(5) Drawers, woollen long - If available pyjama trousers are preferable.

(6) Ordinary Army issue of battle-dress blouse and trousers.

(7) Windproofs. - Windproof material is made of specially prepared cotton material, the number of threads in the warp being the same as in the weft. These garments are coloured either drab or white according to whether they are to be used in snow or non-snow conditions. If in the former great care must be taken to keep them, i.e. they should not be worn in camp

(8) Neck squares. - This is made of any soft material and resembles a dish cloth. The object of this article is to seal off the interval between the neck and the clothing and so trap the warm air next the body. If sweating occurs it is removed to allow moisture-laden air to escape.

(9) Helmet, woollen - Composed of heavy thick wool and should be capable of encasing the ears.

(10) Socks. - Two pairs of heavy socks should be worn

(11) Boots. - Should be of frost-proof variety and have a grooved heel so that they can be used for sking. Nails should be few and should be superficial as the metal conducts cold. A pair of felt insoles should be provided. It is, of course, necessary that the boots should be large enough for the wearer to wear an insole and two pairs of socks.

(12) Woollen gloves, 3 compartment i.e. with the trigger finger and thumb separate. - Two pairs; they soon become wet with sweat and should then be changed.

(13) Mittens. - Long woollen knitted tubes to keep the wrists and hands warm.

civilian population in Finmark use in the winter can be replaced according to our experience, to a considerable extent, though not entirely by the above-mentioned clothing<sup>1</sup>

Some people like to wear the so-called brynje vest<sup>2</sup> nearest to the skin under the woollen shirt, thus creating a layer of insulating air close to the skin, and preventing moisture from the skin from making the shirt wet. This brynje vest has been a regular item in our soldiers' winter equipment. Theoretically it is very rational. Personally I must confess that although I have tried it, I do not use it, except when skiing on warm, sunny days in the spring. I do not think it keeps one warm in severe cold.

*Experience*—In the winter storms of the mountains and forests of the north, an inexperienced person, even if he is equipped with the best and most adequate winter clothing, will soon freeze to death. An experienced person, even if his winter clothing as often happens, is not complete, may still have a fair chance of survival.

It is not only the question of having the clothing but of using it. It is essential to know when to put on and take off clothes as one goes, trying as much as possible to keep warm, but not to sweat to keep dry as long as one can, to change, and to dry wet clothing to use the snow for cover when necessary and prevent it from making the boots wet to dry the boots in the sleeping bag the stockings and mittens by carrying them on the breast, nearest to the skin to economize with dry socks, shirt and underwear and to know the right moment to change to move the toes and to withdraw the fingers to the main compartment of the mittens when they stiffen to put on snow spectacles at the right moment to know when to take shelter and when to carry on, and a thousand other things, which the experienced will do without thinking of them, but which all together represent an instinctive reaction indispensable for survival in the arctic winter.

Then comes the psychological factor. For a man who has been brought up with snow and winter sports, skiing in brilliant, flaming northern lights or in bright sun in blistering cold over the white shining mountains is a supreme delight, comparable with nothing on this earth, whereas for one who does not know how to use the snow and his skis it may often prove a rather depressing experience.

Thus the snow may create great difficulties in winter warfare. The outcome will to a great extent depend upon how these difficulties are

<sup>1</sup>In the winter 1945 I covered some 1800 kilometres on skis and with reindeer transport in Finmark. I found, as on previous occasions, that a skier as long as he is moving, will keep warm in this clothing with double wind-proof suits, even in the most severe cold. (The British Burma dress proved excellent in Finmark.) Sitting or hours in an open pulk or reindeer sledge will, however, require fur (best reindeer) clothes and fur moccasins with semnegress. Reindeer sleeping bags are a necessity when sleeping in the snow without tents.

<sup>2</sup>Designed by the Norwegian Captain Brun during the last war 1914-18. Knitted of strong thread and used as an undergarment.

protection against severe cold, have the disadvantage of being very difficult to dry once they have been wet. In addition felt boots and fur moccasins or 'skaller' (hoods) are not suitable for ski-ing. This is the reason why our soldiers were not equipped with fur clothes, except for special units. A few words about Norwegian winter equipment may be of interest.

For many years the standard winter clothing for ski-ing and outdoor camping in the winter has been

Shirt, thick, long, woollen	2
Underwear, thick, long, woollen	2
Gabardine (Burberry) dress, tight, thin, of battle-dress type	1
Wind-proof suits - annorak (jumper with attached hood) and long trousers, white, camouflage	2 sets
Ski-boots, metal-free, very thick, 2 sizes larger than civilian	1 pair
Woollen, thick insoles	2 pairs
Stockings, long (over the knee), very thick, woollen, large	2 pairs
	(1 in the rucksack)
Rag socks, very thick, large socks of goat rag	2 pairs
	(1 in the rucksack)
Water- and wind-proof cover for the boots	2 pairs
Gaiters - wind-proof	1 pair
Scarf, long, woollen	2
Cap, wind-proof outside, woollen inside, with ear warmers	1
Mittens - woollen, and sufficiently large for all fingers in one space	3 pairs
	(2 in the rucksack)
Pulsvanter - long woollen gloves up to the elbow	1 pair
Wind-proof, and, if possible, waterproof cover for mittens	1 pair
Bergan's rucksack <sup>1</sup> - waterproof	1

<i>In the rucksack</i>	1 extra woollen shirt
	1 extra woollen scarf
	2 extra pair of woollen long stockings
	1 extra pair of woollen rag socks
	1 extra pair of woollen insoles
	2 extra pair of woollen mittens
	1 Icelandic sweater (very thick, woollen).
	1 pair of snow spectacles
<i>If available</i>	1 pair of fur (reindeer) moccasins
	1 pair of fur (reindeer, seal) blade gloves

Our soldiers' winter clothing was the same, with the exception that instead of the gabardine (Burberry) dress they had thick, woollen uniform, 'trigger finger' in their mittens, and in their rucksack a triangular canvas sheet, and one sleeping bag.

Under arctic conditions (i.e. in Finmark) fur moccasins and fur gloves equipped with 'sennegrass' (dried moor grass) are indispensable. Fur clothing ('pesk' (cloak) and 'skaller' (hood)), such as the whole

<sup>1</sup>Designed by the Norwegian Bergan, and used as standard rucksack in our Army since 1917.

For transport in the first line pulks (sledges) toboggans or ski sledges must be available. The next stage will often be horse-drawn sledges. There is much more need for horse-drawn transport in the snow than on dry land. Weasels, if available, are invaluable for transport of wounded in the snow in open country outside the roads. Motor vehicles should have 4 wheel drive. Ambulance cars must be provided with adequate heating motor-cycles with skips etc. Before the wounded man is put into the sleeping bag the injured part should be immobilized and his boots should be removed and placed with him in the sleeping bag.

No other clothing should under any circumstances be removed before the wounded man is in warm shelter.

Tactical principles are the same as in other kinds of warfare evacuation to the rear as soon as possible. In forward areas only life-saving operations or for making the wounded transportable should be undertaken. There may however be conditions where quick evacuation to the rear is impossible. If small ski units are fighting far away from their base, and outside the roads, it may be necessary to treat and to hold the wounded at a regimental aid post for several days. Thus it is necessary to have for such purposes adequate tents with tent-ovens and ample medical and surgical equipment for the most urgent cases.

JANUARY 1943

## EXHAUSTION IN RELATION TO FIGHTING EFFICIENCY REACTIONS OF MEN TO LONG PERIODS IN OPEN BOATS

SURGEON CAPTAIN MACDONALD CRITCHLEY R.N.V.R.

*Consulting Neurologist to the Royal Navy*

The term exhaustion is still devoid of precision in medical parlance. It suggests the idea of fatigue in excessive degree, but the phrase exhaustion-state has been made to refer both to a syndrome produced by the fatigue of excessive muscular effort, or to a nervous in which physical tiredness is a prominent symptom. It is also arguable whether the word exhaustion should be restricted to the effects of physical fatigue, or whether - as seems more likely - it can fairly be expanded to include the results of exposure to climatic extremes or to inanition lack of water pain, discomfort, insomnia, excessive noise and anoxemia.

At one end of the scale we have the term exhaustion-state used as a euphemism for simple and purely psychogenic conditions of anxiety



overcome by each fighting force, and the difficulties themselves therefore a most valuable help for the experienced

This may be illustrated by the following facts. During the campaign in Finmark, 1945, units from the Norwegian brigade trained in Scotland and from the Norwegian training camps in Sweden, operated on the Finmark plateau over huge areas, first in severe arctic frost, later, in the spring, with very wet, melting snow at daytime and hard frost at night. They had no houses, but lived in tents, caves in the earth, and cellars of ruined houses. Patrols and small ski-units covered marches up to 600 miles on their skis, only equipped with wind-proof suits. They did not bring tents or sleeping-bags with them on these patrols, when speed on the skis was a determining factor. In the period from December to April no case of trench-foot or frost-bite occurred amongst our regular troops.

This is of interest compared with the very great number of trench-feet among American troops in the Ardennes in December, 1944, and with the still more astonishing fact that two American divisions in southern Italy had 1,500 men in hospital for trench-foot in February and March 1944. I was there and know that the winter, even in the mountains, was very mild.

It is because of all these facts that I believe that an expeditionary force from the United Kingdom would not be able to conduct mobile warfare under arctic conditions or in hard winter with heavy snow.

Training for winter campaigning in the snow takes years and must be done under climatic conditions which do not exist at all in the United Kingdom, nor even in Scotland, although they do exist in many parts of Canada and U.S.A. The point is not so much to train the soldier to race downhill in 'slaloom' and 'utfor'<sup>1</sup> but to march on his skis mile after mile, hour after hour, day after day, maintaining his speed and fighting condition, and being able to protect himself against moisture and frost when he is resting. The food required under such conditions must be very rich in fat, and should contain 4,500-5,000 calories. Motor vehicles require special service by experienced personnel. Aircraft which land in wet melting snow in daytime must be regularly moved to prevent their becoming fast in the ice when the night frost comes.<sup>2</sup>

*Care of wounded in winter campaigning* - The main problem is to protect the wounded against the cold. This is a question of

- (a) *Collecting the wounded as soon as possible* - A wounded man who is not able to move will freeze to death in a short time if left alone in hard winter frost.
- (b) *Equipment* - Heavy sleeping-bags, if possible reindeer fur, split in the whole length, are indispensable. Chemical heaters in great numbers.

<sup>1</sup>Ski-tracking downhill, on a zigzag and in a straight course respectively.

<sup>2</sup>During the Norwegian campaign, 1940, a British fighter squadron landed on the ice of a Norwegian lake. It was springtime, sunny, and there was melting snow and water on the ice. The young pilots were told to move their planes every hour to prevent them from freezing to the ice. They did not do so. During the night the wet snow and water froze to hard ice. The planes were completely stuck. In the early morning they were attacked by German Stukas. The British fighters were not able to take off and the squadron was almost completely destroyed.

physical and mental normality and to gauge the prospects of his getting back to duty afloat. And even to study his after history and to determine whether there can occur any late complications, whether latent neuro-psychiatric disorders - e.g. cerebral syphilis, endogenous psychoses - are ever precipitated (or apparently precipitated) by the ordeal of such a hardship.

The earliest mental changes are affective in nature, and reactive in their behaviour. They range from acute anxiety while struggling in the water to wild elation when picked up and dragged within a lifeboat. This excitement slowly passes and may settle down to an irritable apathy with a mild depressive colouring punctuated however by peaks of elation or despair according as the prospects of being rescued loom up or recede.

In passing one may refer to the very complicated, and little known, agonal bioscopic fantasies, panoramic memories and the like, which seem to occur not infrequently when a man is fighting for his life in the water. Two examples will suffice.

A sailor was kept up in the water by his lifebelt for twelve hours. Towards nightfall he began to lose hope. His mind began to wander and he imagined he saw himself and his fiancée (who had been killed in an air raid some months previously) leaving a local Palais de Danse as they had often done in the past, they were with friends and were laughing and joking. He then saw his pet dog 'Beauty' which used to be his in boyhood and which had died when he was seven years of age. Other scenes, mostly from his schooldays, came before him - the events all being ones which he had certainly experienced but which he had forgotten. Although the content of these fancies was not unpleasant, he became frightened thinking they presaged death.

The other example concerns a longer-drawn-out experience. An officer "in the ditch" for eight hours, after four hours swimming passed into a state of euphoric confusion with delirious fantasies. He believed he was going to die, but this did not distress him - his sole worry was the idea of disfigurement, for he kept vividly recalling the bloated features of a corpse he had once seen in the water. On this account he deliberately took off his life-jacket so that he should sink. He felt quite warm and happy and having got into an easy stroke, was singing to himself. He was elated at finding he could use his wounded arm. He began to talk aloud to his mother and also to a girl friend with whom he had once gone on a long swim some nine years previously. At the same time he reviewed mentally all the mistakes he had made in his past life - dispassionately and without regret. When a lifeboat drew near he actually avoided it, not wanting to be rescued. He swore at the men in the boat and cried, Go away you bastards. They dragged him inboard however and then he broke down in tears.

As hardships pile up amongst the lifeboat company the sensorium becomes clouded, as shown by a defective appreciation of time, an

with depression (the 'true neurasthenia' of some authors) A tendency to use the term in this way is to be seen in some of the British psychotherapeutic writings in the last war At the other extreme we have the profound mental and physical sequelæ of the more extreme ordeals such as might be suffered in warfare Here we find the expression of opinion of the more scientific German school of psychiatry (as opposed to psycho-therapy). In the case of the latter we have a relatively scant literature, and most of what has been written is of German authorship and dates from experiences with Serbian prisoners in the last war Thus the work of Brugsch dealt with the physical effects of severe exhaustion (especially the cardiological side), while Krehl dealt with the role of the endocrines and especially the adrenals, and, lastly, Bonhoeffer on the psychological features of conditions of exhaustion Other psychiatric papers dealing with exhaustion states in the last war were those written by Mayerhofer, Mann, Wollenberg, Weygandt, Rittershaus, Wittermann, Steiner, amongst others

Obviously if we are to study the subject scientifically, we shall do well to select first those cases where 'exhaustion' in the widest sense of the word, and of the most intense nature, cannot be gainsaid, as the direct and purely physicogenic ætiological factor

In no circumstances do such factors obtain more unmistakably than in the case of the torpedoed sailor who, attaining his frail-rescue-bark after some hours in the water, spends the following ten, twenty or thirty days in an open boat, at the mercy of mountainous seas and arctic cold (or maybe the equatorial heat); wounded perhaps, or burned or scalded, with little or no food, tortured by thirst, unable to sleep from overcrowding, discomfort, pressure sores, boils and salt-water burns, in the company of shipmates who are becoming delirious or who are dying off one by one

The psychological state, in such conditions of unbelievable hardship, is not a fixed one, for it alters considerably with the passage of time, with the accumulation of increasing duress, the steady deterioration in the physical strength, and the vacillations between wild hope and deep despair as aircraft and ships are sighted, but only to pass unheedingly The psychiatric picture also varies a good deal from one individual to another, depending largely upon such factors as race, and previous personality The behaviour and morale of a lifeboat's company differs also, depending largely upon the presence or absence of commissioned officers or petty officers, who by their conduct and bearing will exercise a powerful effect - either for good or for evil - upon the hyper-suggestible crew

It would be a long task, though an interesting one, to give a kaleidoscopic picture of the psychological state of a torpedoed sailor from the time he abandons ship, until eventually he finds himself comfortable and safe on board a rescue-ship, and perhaps to follow his later progress and to note his reactions ashore, the rate of return to

Two F.A.A. officers adrift in a dinghy kept imagining there was a third person along with them. Another shipwrecked man had the idea, while adrift, that right astern of him was a ship with a lowered boom. Although on looking around no ship could be seen the impression kept returning.

The mental state after rescue when the physical exhaustion is in process of amelioration and when mental distress is subsiding is usually one of euphoria, with motor restlessness and insomnia. Hypnagogic hallucinations or vivid dreams are common. A secondary anxiety is very common, bound up with fears that the rescue vessel itself will be torpedoed and that they will never attain the safety which now seems only just beyond them.

Later still, and once ashore late reactions of an anxiety type are not uncommon and more typically a depression.

Possibly the severer psychiatric reactions are commoner after the longer lifeboat voyages with the greater death-roll in other words some parallelism between physical stress and the severity of later psychological reactions may seem to exist.

One must emphasize that persistent psychiatric incapacity is the exception and not the rule. It occurred in only 50 out of my series of 285 shipwrecked sailors – or less than 18%. The frequency with which one encounters naval ratings and merchant seamen who have been ditched two three, four times (or even more) testifies that most men return to duty afloat. Even when an anxiety develops, it may be specific and not concern other kinds of hazardous duties. Thus a survivor from a torpedoed cruiser who had endured particularly intense sufferings returned to duty and served as a diver – a risky and unpleasant occupation. Only when put on draft for another cruiser of the same class as his old ship did an anxiety become manifest. Yet another survivor from a cruiser volunteered for the submarine service, in which he carried on efficiently and without symptoms.

MARCH 1943

## SIEGE CONDITIONS IN MALTA 1940-1942

BRIGADIER H. B. F. DIXON M.C.

*Lt Col. D.C. 90 General Hospital and S.M.O. Malta West*

Malta is 17 miles long by 8½ miles wide, 94 square miles in area and would fit comfortably in Greater London between Greenwich and Edgware to the West, and from Hampstead to Wandsworth in the South. The population is 240 000 giving a density of 2 500 to the

increasing lack of awareness, a tendency to day-dream (particularly on themes of food and drink), and later in fantasy-building, in actual vivid hallucinations usually visual, and in delirium

All this time the behaviour of the men within the lifeboat will exhibit the characteristics of the psychology of the mob, or the herd, so ably studied by Le Bon, and afterwards reaffirmed by Trotter. One of the most striking of these traits is a heightened suggestibility. This shows itself in many ways, in an exaggerated dependence upon the influence of the charge hand or officer in command, in the way in which one man will follow another in action or speech. If one man shouts, the others may do the same, if one sings, the others take up the song; if one stands up and waves, the others may do likewise.

The hyper-suggestibility is seen best of all in the way in which delirious fantasies, or hallucinations, are shared, leading to a collective confabulation and mass-misinterpretations. The delirium of these men is usually simple if not banal, and the *motif* is mainly concerned with eating, drinking, warmth and rest. The man imagines he is at home with his wife and children, sharing a meal, or back in the ship about to sit down at a well-stocked mess table, or in a favourite public house ashore. One man says he is going below to wet the tea and another says 'Wait, I'll join you'. Both step over the side and are lost. Or one says 'Who'd like to come and get a beer with me?', another would join him, and a third would offer him money.

Two officers were adrift on a raft in the North Atlantic. One of them spoke as though he were ashore, staying at a fishing-inn in Killarney, the other, falling in with his suggestion, discussed the menu. Both men complained of their discomfort, and, not understanding why the amenities should be so poor in such an expensive hotel, decided to complain to the management.

Visual hallucinations may develop at a period when the sensorium is intact, or very nearly so. Here again the theme is simple, and is bound up with ideas of rescue and relief. Again this mental phenomenon may be shared and illustrate the 'mental contagion' of Wollenberg and others. Thus the shipwrecked man may imagine he can see land in the distance. He announces this and then others begin to imagine they can see it too, and then to elaborate on it - for one man says he sees trees, another a dockyard with cranes, and slipways, others add details about phantom ships and aircraft. So realistic are these collective visions that the men will often pull for hours towards these imaginary ships and coastlines and even after rescue the impression of reality may endure.

One may also refer to a more subtle delusional experience which has at times been noted in circumstances of severe exhaustion, namely the impression or belief in a 'presence'. The feeling is an intangible, extra-campine one for 'it' is neither seen, heard, nor felt. Two examples may be given.

Maltese. Families including Maltese, had risen to 5,474. Conscription was immediately introduced on the outbreak of war and a Home Guard of 3 000 was formed from the older men. At the hospital we had 50 Maltese V.A.D.s.

After Crete our biggest fear was a parachute landing everyone was armed at all times and patients brought arms and ammunition into the hospital.

Medical personnel on the Island on June 10, was 30 M.O.s, 40 Sisters and 150 R.A.M.C. At the commencement of the siege there was only one military hospital on the Island, No. 90 General. This had been the old military hospital at Imtarfa close to Ta Hali aerodrome and expanded from 100 to 1,360 beds. Owing to the closing of the R.N. Hospital at Bighi this hospital took in all naval casualties assisted by a detachment from the Naval Medical Services. Further medical units arrived in 1941 161 (E.A.) Field Ambulance which took over the medical arrangements of the S.F. corner of the Island, another Field Ambulance a Field Hygiene Section and a Base Depot of Medical Stores and a convalescent depot were formed locally.

Two general hospitals of 600 beds arrived in 1941 one arrived minus equipment and only opened in February 1942 but was completely destroyed by bombing two months later. The other which opened in August 1941, had two wards destroyed in April 1942.

No medical reinforcements were received on the Island after September 1941, until December 1942. There was a good civilian medical service, almost every doctor in Malta being wholly or partly employed by the Government although allowed to do private practice.

An emergency medical service on the lines run in England had been prepared and functioned extremely well. Numerous schools had been taken over and the civilian service coped well with all the demands made on it. There was complete reciprocation between military and civil.

The shelter life, however, had a very adverse effect on the health of the people. The overcrowding, the communal living, lack of proper facilities for cooking and washing, etc. all took their toll.

The people at the extremes of life were especially affected and the death-rate went up from 21 per 1 000 to 30 per 1 000. Tuberculosis, scabies, etc. increased enormously but thanks to the energy of the Chief Government M.O. Professor Bernard, and his staff there were no major epidemics. A system of medical and sanitary surveillance was instituted for all dormitory shelters daily medical inspections took place and there was wholesale inoculation and immunization with T.A.B. and T.A.F. Fleas were in appalling numbers in the flea season.

Many problems with regard to water were created by the migration of population and the destruction of reservoirs two of which received

square mile, most of whom live in the area round the Dockyard - Valetta - and the three cities Vittoriosa, Conspicua and Senglea

The island is flat, the highest point being only 800 feet up, and one can have a bird's-eye view of the whole area from this point. Contrary to popular belief there were no underground shelters at the commencement of the siege except those in the old fortifications at Valetta which were built to resist the Saracens many centuries ago. There were a number of slit trenches cut in the rock capable of holding 15 persons standing without overhead cover - these had been commenced at the time of Munich.

Deep shelters were only started after the first bombing and were not completed by the spring of 1942.

Although the Island had been on a war footing since 1939 it was always felt, certainly by the Maltese, that Italy would not come into the war, and the first bombing which took place at 7 a.m. on June 10 was a complete surprise to them - they certainly never realized that war would be like this. Civilian casualties on that morning were 23 killed and 110 wounded but only 7 military casualties. The bombing caused a sort of 'primary shock' and there was a wholesale exodus from the dockyard area by car, trap, mule cart, donkey cart, hand cart and perambulator.

After forty-eight hours morale reasserted itself and most of them came back. Shops opened, buses ran and the Maltese began to dig in. From that day the morale was excellent. Slogans like 'Bomb Rome' appeared on all the walls and it was considered a disgrace to be hit by an Italian bomb.

The forces available for the defence of the Island were pitifully small. The sole air defence was three obsolete Gladiators which had been used for training anti-aircraft gunners. They went into the air and took on the powerful Italian air fleet. How they managed was a mystery - there were never more than two serviceable at any one time. They were affectionately known as Faith, Hope and Charity. They saved Malta and their six pilots deserved all the praise and honours they got. The Gladiators held in very truth the Fortress until some Hurricanes arrived at the end of June. On the first day they, with the A.A. gunners, brought down three Italian planes.

There were five British battalions on the Island, two A.A. regiments, two Maltese battalions and a dockyard defence battery plus coastal artillery.

The Navy had gone to Alexandria leaving one monitor, two gunboats and a few destroyers.

The total Army strength on the outbreak of war with Italy was approximately 6,500 British and 4,000 Maltese troops, 500 women and 700 children.

During the siege reinforcements came at varying times until in 1942 there were about 25,000 troops of all British Services with 10,000





direct hits with the loss of millions of gallons of precious water and the flooding of deep shelters and trenches as the water coursed down to the sea

Fuel was another problem. There is no coal or wood on the Island, both of which used to be imported. Coal on the black market was £14 a ton. Cooking was done with flash cookers and sump oil from aeroplanes. Paraffin was rationed at half a gallon a week. When things got desperate paraffin was brought in by submarine. All private cars were taken off the road when the siege began. There was a five-day week and buses only ran for two hours in the morning and evening to take the 15,000 workers to the dockyard.

Silver and copper disappeared. Bicycles soared in price, an old second-hand one being sold for £17.

Most of the civilian hospitals were hit by bombs at various times during the siege, the new civil hospital was hit on the first day. No. 90 General, Imtarfa, had about 100 bombs at various times on the hospital area of 125 acres overlooking Ta Kali aerodrome which was used by our fighters. Only on one occasion did the bombing appear to be deliberate. It was on Easter Sunday, April 13, 1941, when 35 bombs were actually dropped on the hospital grounds and buildings causing casualties and much damage.

On the Italian wireless the following day it was said that the Germans had bombed Imtarfa Hospital as a reprisal for an attack on one of their field hospitals in Libya. During the siege the Officers' and Sisters' Messes received direct hits, two Sisters and one M.O. being wounded, and accommodation for 400 patients being destroyed.

The proximity of the fighter aerodrome gave us many bombs not really intended for us – the aerodrome originally was three miles away, but with the necessity for dispersal of planes it gradually approached the hospital until it was only 400 yards away.

One of the smaller hospitals was put out of action completely in April, 1942, but it, too, was near an ordnance dump.

Evacuation of patients from the Island presented great difficulties. During the early part of the siege we got some away on H.M. Ships and Merchant Navy convoys, but these ceased to come regularly. The first and only hospital ship came in the spring of 1941 and took away the wounded from the *Illustrious* which had been badly damaged coming in to Malta. We were lucky to get the hospital ship loaded without a big raid.

Otherwise we had to rely on chance destroyers or planes going either home or to Alexandria, but on the whole there was little chance of evacuation.

After the loss of the food convoy in the spring of 1942 rationing became much more strict and there was a serious shortage of food on the Island. This got steadily worse. At no time, however, were the troops' rations below 2,300 calories but the civilian ration fell at one

time to between 1 200 and 1,500 calories per day. There was no obvious illness as the result of the cutting down of food except loss of weight - many people lost 1 and 2 stone. Marmite was issued to troops three times a week and vitamin concentrate to women and children.

Drugs and dressings had to be sparingly used. Sulpha drugs and X-ray films were short. Insulin ran out, also calf lymph. At the worst period we were down to one month's supply of drugs and apparatus and to two months' supply of films. Laboratory and dental equipment were nil. Many small items were brought in by air and submarine.

Casualties among British troops are not known but between 1.1.42 and 30.6.42 there were 1 300 of whom 350 were killed or died of wounds.

On the whole the civilian casualties were greater unofficially. I understand there were 2 000 killed and about 4,000 wounded. There was a wonderful opportunity of getting rid of Malta fever during the siege as most of the goats were killed during the summer of 1942 mainly on account of difficulty in fodder for them and to provide food for the Maltese. This caused great resentment among the Maltese as they are very fond of their goats.

The reaction to bombing on the part of the staff and patients varied from time to time. In the beginning no one took shelter - everybody was too interested in what was going on and one had to force the personnel to take cover. Later when the bombing got worse there was a dash for cover and there was a tendency to stay underground too long. In general however, everyone carried on as usual. Our theatre was on the top floor of the hospital and fortunately was never hit. A complete underground hospital was planned and started but up to the time of my leaving the Island had not been completed.

In 1942 the bombing was continuous day and night for six weeks. Sometimes 200 or 300 planes would attack in one day. Very ill patients with major fractures were treated in the deep shelters. Less ill patients went to ground during alerts. A considerable proportion of patients remained in their wards and morale was high even when bombs were heard whistling down near by.

The civilian morale was excellent despite the fact that they had the brunt of the attack and their casualties were high. Many of the older and younger people remained permanently in the shelters. Many children were born there and frequently people died in shelters. The conditions in civilian shelters were incredibly difficult owing to dampness, flooding, difficulties in feeding, cooking and sanitation.

There was electric light on the Island in most of the towns and big villages. Unfortunately the power house was near the dockyard and was frequently blitzed. Lights always went off for a variable period after each heavy raid - it was amazing how they came on so quickly.

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go as it did. Our plans had all been made for a prolonged campaign, and our preparations made to build up an elaborate line of communication behind the supposedly impregnable defensive position in the mountain ranges in the north of Greece.

*Hospitals* - When we arrived, there was only one hospital - 26 General in a suburb of Athens called Kypfissa. This had 600 beds distributed in three luxury hotels all close together in this health resort of the Athenians.

Expansion of the hospital to be ready for emergency was our first consideration as it was the only British hospital at the time available for troops then arriving in large numbers. One could not ask the Greeks to help at all as every available inch of space in Athens was crammed with their own wounded resulting from their campaign against the Italians. In fact we were helping them, for our hospital accommodated quite a number of Greeks. I paid a visit to some of their hospitals early in March at the invitation of the D.M.S. of the Greek Army and found them spotlessly clean, but hopelessly overcrowded with wounded, which included large numbers of cases of severe frostbite resulting from fighting the Italians in the thick snow of the hills and passes. Every bed was full, and the floors of wards and corridors so crammed with stretcher cases that one could hardly move between them. Nursing must have been very difficult. It was obvious that we could not ask the Greeks to do anything in the way of accommodating British sick and wounded and therefore an immediate expansion of the one hospital we had open at the time was pushed on with at all speed. Tents were erected on the lawns and tennis courts of the hotels and concrete bases put in. Beds and bedding were requisitioned from hotels and in a very short time further accommodation up to 1,200 beds was arranged around the central cookhouse and operating theatre. It is, of course, very much quicker to expand an existing hospital by 600 beds than to set up a new one of 600 as it is the administrative surgical and laboratory arrangements of a new hospital which take the time to get going.

*Field Ambulances* - In addition to this hospital in Athens we only had at the beginning of March a company of a field ambulance. This was at the time acting as a reception station in Larissa, a town just short of the mountain barrier in the north of Greece. This also had to be made capable of accommodating casualties, for a time at least, until they could be evacuated, and until new field medical units arrived. There were no buildings in Larissa suitable for hospital purposes at all, and therefore tents were supplied and stretchers and palm beds provided so that lying down accommodation in tents for 200 was quickly afforded. It was thought Larissa would be a certain target for enemy bombers as it was so near the front line and therefore when setting up this improvised hospital in tents, we had to pay

As the siege went on lack of fuel restricted the use of electricity to short periods. Finally it was cut off entirely from May to October 1942. At the hospitals we had our own emergency supply which, however, could not run the lift or X-ray, causing much interruption in the work of transporting patients.

Despite the incessant bombing and hooting of the siren (there were 3,240 air-raid warnings up to January, 1943), despite the lack of food, mail and home leave, the incidence of psychoneurosis was amazingly low. Out of 2,307 admissions to 90 General Hospital during the worst period of the bombing, April to July 1942, there were only 57 cases of psychoneurosis. Out of these 57 from all Services 30 were returned to duty, 12 were invalided, 15 were expected to return to duty. Another hospital in two months in 1942 admitted 702 patients of whom 171 were battle casualties and 17 cases of psychoneurosis. It is not quite clear why there was not more frank psychoneurosis, possibly because there was no escape, no hope of evacuation to U.K. and admission to hospital was just as dangerous and unpleasant as remaining at duty and trying to carry on. It is also interesting to note that there was no official military psychiatrist on the Island.

Malta was an experience – an experience not likely to be forgotten. The morale was high all the time. General Dobbie inspired us – “The sword of the Lord and of Gideon.” The R.A.F. was superb. The morale and the pluck of the Maltese people were a revelation.

There was a comradeship about the men and women who served in Malta which I shall never forget. I am proud to have been there.

(The frontispiece to this book was kindly supplied by Brigadier Dixon—Ed.)

MARCH 1943

## EXPERIENCES OF AN ADMINISTRATIVE MEDICAL OFFICER IN GREECE, 1941

COLONEL D. T. M. LARGE

*A.D.M.S., East Scotland District*

Although we were in Greece from the end of February 1941, the campaign did not start until April 6 when the Germans launched their attack in the north, and carried out a severe air raid on the docks at Piraeus, the port of Athens. The campaign was over as far as we were concerned by the end of the month, so that it lasted just three weeks.

None of us on our arrival had any idea that the campaign would

Our line of communication ran on the eastern side of the central mountain range forming the upright of the letter T. From the front of the defensive position back to railhead at Larissa was a distance of over 100 miles of twisting mountainous road. The railway from Larissa to Athens also runs over mountainous country through deep gorges but at one point in the Parnassus range it was extremely vulnerable to air attack because of a series of bridges. It was estimated that had one of these bridges been destroyed by air attack or sabotage the whole railway system of communication would have been out of action for three months. This fact had to be taken into account in all arrangements for casualties from the front to the base hospitals.

*Medical lay-out* - Medical units began to arrive early in March, the first being a 600-bedded New Zealand general hospital. At that time the urgent need was for a hospital somewhere nearer the front than Athens and certainly in advance of the vulnerable Brallos Bridges. The rail journey from Larissa back to Athens by express train before the campaign started took fifteen hours and during the campaign up to twenty four hours. The only form of hospital train available then had to be obtained on loan from the Greeks and as they themselves had been caught by the Italian war without proper ambulance trains, it was a hastily-constructed affair consisting of cattle trucks fitted with stretchers. The discomfort and length of the journey therefore combined with the danger of a severance of the lines of communication at the Brallos Bridges, rendered it essential to place this New Zealand hospital as far forward as safety would permit and a site at Demerle railway station was chosen. Here the hospital set itself up in tents dispersed at 30 yards intervals and it was a going concern within three weeks from the time of its arrival.

Other medical units were now coming across from Egypt numerous field ambulances which were sited in conformity with the movements and positions of brigades, two C.C.S.s and numbers of the smaller specialized units for example for blood transfusion anti malaria work, mobile laboratories, mobile bath units and last but not least, the complete fittings for a couple of ambulance trains. One of the C.C.S.s - No. 3 Australian - was sent forward to Ellasona well in advance of railhead where it was able to receive casualties from right and left sectors of the front. The other 24 British C.C.S. was sited at Larissa to retain casualties pending their transfer to the New Zealand hospital at Demerle close by if urgent or to the base at Athens by ambulance train.

Two more Australian general hospitals arrived one of 600 beds was opened at Volos, a seaport to the east of Larissa, and the other of 1200 beds was set up near Athens at Kyphissia. An advanced depot of medical stores had also arrived and was opened at Athens.

All these units were open and functioning by the time the campaign

particular attention to their dispersal. Tents had to be 30 yards apart. While this undoubtedly has an effect in *minimizing* the damage from a bomb hit, it also adds greatly to the difficulties of nursing and feeding patients, who are scattered in small groups over an area which may extend over many hundreds of yards. Whether this dispersal is really necessary in the case of a hospital, however, is an open question. It depends so much on the situation of the hospital with regard to other establishments of a military nature which are liable to bombing, and also on the attitude of the Germans themselves. Certainly Larissa was frequently bombed, but the tented hospital there was never attacked. The Red Cross was prominently displayed on the ground and the site was carefully chosen well away from other camps and from dumps. During the actual campaign, some German wounded in this very hospital were astonished when our men went into slit trenches during a raid. 'They won't bomb us,' they said, 'This is a hospital,' and the planes overhead certainly did cease firing as they approached.' On the other hand in Crete, the main landing ground for the parachutists was the hospital area occupied by 7 General Hospital although this also was clearly marked with the Red Cross. Their excuse for this was apparently that the hospital had selected the best ground available on the island for landing parachutists and that if we chose to put a hospital there, that was our look out!

The above was the medical provision in Greece at the end of February, 1941. It was, of course, not intended for the campaign against Germany, but only as medical provision for the airmen and aerodrome guards lent to Greece for her war with Italy.

New medical units commenced to arrive early in March, and continued arriving all that month. Before describing their siting, it is necessary for a moment to state briefly the geographical features on which the campaign depended, on which of course the position of medical units was hinged.

*Geographical features* - Greece is a very mountainous country, but broadly speaking the ranges form themselves into a letter T, with the upright limb running north and south and the horizontal limb roughly east to west. Our forces with their lines of communications were to the east of this T and our defensive position along the mountain range forming the right half of the horizontal limb, which divides Greece proper from the Macedonian plain. (The left half of the horizontal limb was defended by the Greek Army and does not come further into the picture as far as we are concerned at the moment.) This defensive position ran along the northern slopes of this dividing mountain range, from Olympus in the east in a N.-W. direction, but we had advanced units at many points in the foothills and on the plains of Macedonia in front of Katerini, V... Edessa, and these areas gave us much... with a view to prevention of malaria.

Thus the British C.C.S. was the only medical unit left in the advanced base, apart from the field ambulances which were retiring along with the forces they served. The orders given to this C.C.S. were to remain behind as long as wounded were coming in even at the risk of capture by the enemy. It was soon the only unit of any kind left in Larissa, for this advanced base was evacuated by all troops about April 15 or 16. It had laid in a stock of rations but no more could be supplied as the ration stores had also been evacuated.

Evacuation by hospital train however was going on, one of the three British hospital trains coming up daily.

When the troops left Larissa the railway employees also left and soon there was nobody to service the train at Larissa. Loading of casualties, watering and firing of the engine had to be done by the medical staff of the trains. After a few days we received a message brought by the train from the C.C.S. to say that they were now short of rations and medical supplies, so a hospital train was loaded up with rations and medical supplies and sent off. The Creek driver refused to go further than Lamia about halfway and it looked as if the train would have to stop there but the medical officer often used to travel up on the engine and he had watched the man driving it so he took it up himself. Thus he did on subsequent days too getting back 100 cases a day until the C.C.S. was emptied. As soon as it was empty the C.C.S. came back and joined the Australian C.C.S. in the Thermopylae Line.

Here a delaying action was fought for over a week. Casualties were brought back by ambulance train, by ambulance car and by lorry or anything going back empty to the base hospitals at Athens. Many times the railway line was bombed and blocked causing delay to the train or necessitating unloading on to ambulance cars.

The hospitals in Athens soon filled up and became crowded beyond the limits of expansion. To relieve this we opened a camp in tents on a beach near the docks and to this we sent all the milder cases from the hospitals so as to leave more beds for serious cases. This camp had nearly 1,000 in it. We staffed it by personnel from front line units which had closed.

Towards the end of the month we were told to clear out of Greece altogether. Things were pretty bad by this time. The docks at Piraeus the port of Athens had been badly damaged very early in the campaign by the nightly bombing which went on. On the very first day a mine dropping aeroplane dropped a mine on an ammunition ship lying in the docks with the most disastrous results. The ship exploded and blew the dock sheds to bits and scattered burning debris all over the harbour. Dozens of ships caught fire from this or from the burning oil running along the surface of the water. I saw the place only the morning after with the sea still blazing with burning oil and numbers of ships on fire all over the harbour. A small part of the quay was,



opened on April 6, but of the hospitals, only the New Zealand (up the line) and the original British (at Athens) were completely ready with their full complement of beds

Hospital trains, however, had been got ready according to British standards by fitting the equipment received from Egypt into a number of refreshment cars and other stock received from the Greeks. Here may I put in a word of thanks to the Greeks. They were very short themselves of all medical material, and indeed of all war material, yet they did everything in their power to help, and to provide us with our requirements, even at the expense of running still more short themselves.

*The German Attack* – Just when we had got things about ready to receive large numbers of casualties the German attack began on April 6. Casualties began to come down the long winding road from the front, carried by a motor ambulance convoy to the C.C.S. at Ellasona. From here, after treatment, they were mostly evacuated down the line to Athens, but the more serious cases were admitted to the forward hospitals at Demerle and Volos, which were opening to receive them.

As things turned out, it was lucky that we had only very few cases in these forward hospitals, for on April 14, i.e. only eight days after the attack began, we heard at the base that orders had been received to evacuate the advanced base area, which included the forward hospitals, and that a general retreat to the Thermopylae Line was to take place. The Greeks on our left, who for nearly a year had held off the main Italian Army, and indeed had driven it back, had at last had to give in to the overwhelming masses of men and modern equipment of the invading German Army.

*Evacuation* – The orders to evacuate were urgent. It was to be immediate. That is, only patients and personnel, with whatever valuable equipment could be carried by hand, were to go. The orders were received about midnight on April 14. Transport had to be arranged and communication by telephone was very bad indeed. That is always the difficulty in these emergencies. However, the hospital people found that an ordinary train was available in Larissa and they had it moved to Demerle and placed all their casualties on stretchers in it and themselves and their equipment wherever they could find space. The hospital at Volos was lucky too, for the local commander requisitioned a sailing ship in the harbour and they got away their wounded and some equipment, and the remainder of the personnel were sent down the line on lorries.

In addition to these two hospitals, there were also two C.C.S.s which were further forward. The Australian one at Ellasona was ordered to clear its casu British / back at Larissa Line

north of Athens fighting delaying actions so as to let the majority of the troops get away from the beaches in safety. The plans for their getaway were pretty well the same for all the beaches, of which four or five had been chosen at widely separated intervals on the southern coast, each beach being used on three or four successive nights until all troops had been evacuated. Luckily for us the moon was low at this period and the nights pitch black. The plan was that the troops assigned to a certain beach were brought up to the nearest place to it where they could lie up under cover in the olive groves. At nightfall the idea was that they should proceed to the beach in silence and get on board launches or lighters or small boats which would convey them to transports waiting out at sea. No equipment other than a small pack was to be carried because of lack of space on the ships.

In order to be ready for discovery and consequent attack, e.g. by air we had arranged dressing stations both in the 'lying up' area and on the beaches which were formed by the medical personnel of each unit which was embarking. Every casualty who could walk was to be evacuated. Those who could not were to be left with a minimum of personnel to look after them. Their capture was certain and it was hoped that they would be evacuated by the Germans to the nearest hospital.

In the end it turned out that casualties were not so bad as we expected. At most of the beaches there was no attack at all, and it was only at Kalimati in the extreme south, and after the arrival of Germans on the spot, that there was any fighting. Here it was severe and some 200 wounded were collected in the local Greek hospital and had to be left.

I myself came away from Athens with the last of Force headquarters. We were told at 4 p.m. one day to start off at once and join up at Nafpion about 100 miles to the south, with the rest of headquarters at 7 a.m. next morning. We set off in the evening by car and soon joined the procession of cars all making for the south of Greece. It was not, I am afraid a very inspiring journey and it was depressing to think that we were leaving the Greece we had come to defend to be taken by the enemy. Now and then we came across bands of Greek soldiers tired and forlorn, making their way back to their homes from the front to try to get on to their farms as civilians before the Germans came and captured them as soldiers. Here and there were groups of dead horses lying with their legs in the air by the roadside where they had been shot to prevent their being used by the enemy. Everywhere the roads were lined with wrecked motor transport, our transport, hundreds of cars and lorries driven purposely over the embankments to break them up.

Darkness fell and we followed the dismal procession southwards over the Corinth Canal to the town of Corinth which had just been raided, and whose burning houses lit up the whole scene. Past Corinth we drove on through the night finding our way by following the dim

however, still usable and we got a hospital ship into it which took away a good number of casualties. After that no more hospital ships were allowed to come to Greece and we were left with 2,000 or so casualties in our hospitals, with something like 200 nurses. These had to be got away somehow. A ship due to sail on the evening of April 25 from Piraeus was able to take on about 100 with a number of sisters and medical officers. This was, however, bombed and sunk before it left the harbour, but luckily the casualties were few, although the C.O. Australian hospital was killed and the C.O. of the British hospital wounded. This put a stop to any further evacuation from the docks, and therefore stopped evacuation of bedridden cases altogether.

We could not leave behind for the Germans any man who could get on board a ship, and so medical officers were told to collect every man who could walk, no matter what his disability, and to prepare him for evacuation by ordinary ship. These men were all taken down one evening to a beach to the south of Athens and 1,500 of them were collected in the shelter of the olive trees. After dark, the transports which had been detailed for the purpose came close up to the beach and took them off in small boats. We left over 300 seriously wounded behind in Athens. These were all, however, too seriously ill to move and could not help themselves in any way.

We next had the problem of sisters to deal with, and had to decide whether to leave some of them behind with the serious cases or not. I knew of no preceding evacuation in which sisters were involved. It was a difficult decision to make. All of the cases left behind were very ill and much in need of nursing, but were we to leave British and Australian nurses behind to be captured for certain by the Germans? How would the Germans treat Army nurses as prisoners? We did not know. We did know, however, that in the course of a month or two the British casualties we were leaving would have recovered, or would no longer be in need of nursing. Was it justifiable to leave British nurses for several years in prison camps when their job would be over in a couple of months?

We decided to get them away, and we *did* eventually get them all away on a cruiser just a few days before the Germans came in. We had sent them down to a beach during the day, hiding them under olive trees, and then when darkness fell a cruiser came inshore and took them off in small boats.

But the patients were not after all left without nurses. The Greek D.M.S. sent me 80 Greek V.A.D.s on the day our own nurses left, another example of the kindness so frequently met with from the Greeks at that time. They knew we were leaving them to the Germans, but they still were grateful for the attempt we had made to help them in their struggle. These Greek V.A.D.s had been specially selected for the job, all who knew any English being chosen. This happened about three days before the Germans came into Athens. We still had troops

jeep into a jeep-ambulance which would quickly and safely transport casualties over rough ground and beaches.

The 11th Field Ambulance was also detailed to set up a dressing station on the beach to help to treat what casualties it could until they could be loaded on assault craft which had brought in the various waves of troops. These craft were then to convey the casualties either to the landing ship infantry or to one of the destroyers for transport to England.

Many weeks of preparation with various postponements due to weather finally found the men very well trained, and fit and keen to do the job.

Two ports were chosen for the reception of the casualties in England. The first and main port was Stokes Bay near Portsmouth where many exercises in the evacuation of casualties from landing craft tanks and other ships were carried out with the able assistance and direction of Surgeon Captain Millar R.N. The other port chosen was Newhaven where only a few casualties who got separated from the landing flotilla were expected.

On the morning of the raid, August 19-20 1942 10th Field Ambulance proceeded to Stokes Bay in the very early hours and, under most adverse conditions of wind and rain, set up their main dressing station to receive casualties. What occurred is now a matter of history. A great many casualties were taken off shore in whatever boats they could make, and it was almost impossible to secure any information as to where or when they might arrive in England. In the late evening of the same day we finally confirmed the fact that the casualties were mostly on destroyers and would not arrive at Stokes Bay as planned, but at the docks in Portsmouth. It was therefore necessary to make a complete switch of both the main dressing station, 10th Canadian Field Ambulance and No 2 Canadian Motor Ambulance Convoy from Stokes Bay to the Unicorn Docks, Portsmouth. This move was made in blinding rain without accident of any kind. The motor ambulance convoy was divided into sections and it was distributed from the docks along the roads leading to Bramshott. The dressing station was quickly set up in a building on the docks and was completely ready when the destroyers *Fernie* and *Calype* finally arrived in the early hours of August 20.

In the early stages of the evacuation of casualties from the destroyers some confusion was caused largely by the overcrowding of the docks, but by five o'clock in the morning all casualties had been evacuated from the destroyers, treated at the dressing station sorted and transported to hospital.

Later in the morning of August 20 casualties arrived in very small numbers on a few of the landing craft which had made their way to Stokes Bay Harbours. These were taken care of and transported to hospital. Naval casualties were sorted at the docks and for the large part trans-

whiteness that marked the road. Rough cobbled stones underneath the wheels told us we had arrived at Naphion, and with it to the end of the story

There was no difficulty about our evacuation. We lay up in olive groves all day hidden from the Germans flying overhead and watching them bombing the quays and the roads. Now and then a bomb would come fairly near, and we crouched in our ditches trying to make ourselves as small as possible. As soon as night fell we marched down to the jetty, which was still intact after the bombing, and got on board a ship, just as if we were going on a Sunday excursion. There was no bombing, no casualties, no hurry, and not even darkness to hinder us, for the flames from a burning transport in the harbour lit up the decks as we arrived, and acted as a beacon as we sailed down the harbour on our way to Crete.

MAY 1943

## THE DIEPPE RAID

MAJOR-GENERAL CHARLES P FENWICK, C.B. C.B.E., M.C., E.D.

*Late A.D.M.S., 2nd Canadian Division*

Early in 1942, when the planning for this 'reconnaissance in force' was undertaken it was decided that the medical plan would have to be flexible enough to evacuate casualties quickly from the beaches and transport them as swiftly as possible to England for sorting and hospitalization. As it was not considered at any time that any part of the force would remain ashore longer than was necessary to secure the objectives the plan was made to supplement the regimental stretcher bearers with sections of field ambulances. No. 11 Canadian Field Ambulance was chosen and trained as the unit to proceed with this force. Each section of the field ambulance was composed of an officer and eleven men and the equipment was thoroughly supervised and an attempt made to provide what was most suitable. Special packs consisting largely of shell dressings, morphine, sulpha drugs and plasma were provided, and the equipment was so divided that each man had some of it to transport.

To implement this plan No. 11 Field Ambulance proceeded with the 5th and 6th Brigades to the Isle of Wight in early May and exercises in combined operations took place for many weeks. Each officer and man was thoroughly briefed. He received instructions on model maps until he knew, as nearly as possible, the exact nature of the terrain he might have to cover after landing. Vehicles, except jeeps, were out and many attempts were made to convert the standard

I had previously had liaison with the medical officer in charge of this section and given him details of the proposed sites of my regimental aid post, as the regiment withdrew towards and through Dieppe where we were to re-embark.

My stretcher bearers were given their final instructions and we then rearranged our packs in preparation for the assault landing. Medical supplies, including four Neil Robertson stretchers, had been placed previously on board ship in order that there would be no suspicions aroused as to the nature of the exercise. I had also brought along some extra shell dressings and when all the stores were finally packed along with the equipment we normally carried we were pretty well loaded. The regimental aid post equipment such as instruments, reserve sulphanilamide powder morphine, etc. were divided between the medical sergeant, the corporal and myself in order that if one became a casualty the others would have sufficient supplies to carry on with treatment of the wounded.

At about midnight we had our final lunch and received extra food which we were to take with us. Soon afterwards we were taken in landing craft from the mother ship towards the beach. It was a pleasant warm night, with a starlit sky and calm sea. The boys behaved as though it were just another scheme some dozing off to sleep to the quiet purr of the motors. As we approached the beach we could see tracer bullets shooting up in the air some distance to the north and wondered if the Royal Regiment was landing before the scheduled time.

Our landing at first light was silent and almost unopposed. A few casualties were sustained at that time and these were immediately removed back to the landing craft and taken away. We saw some of the troops climbing up the seawall and going through a small door in a machine-gun post, so we followed suit. At this time I was feeling quite happy about the situation as I had anticipated more trouble in landing.

We soon found our battalion headquarters group and while there, a German casualty with his arm almost amputated at the shoulder, was brought in for medical care. While I was attending his injury our battalion headquarters moved ahead, and before his dressing was completed there were calls for us to care for wounds received by several members of battalion headquarters and a number of German prisoners from a mortar bomb explosion.

Casualties were brought in quite rapidly for some time. Later it became apparent that the field ambulance, should it land at Dieppe, would be unable to send vehicles or stretcher bearers to our location owing to enemy fire which had not been overcome in that direction. Therefore, all casualties, after receiving treatment, were evacuated by stretcher or walking to the machine-gun post on top of the seawall where we had originally entered, and lowered out of the small opening

ported to Haslar Hospital. Many of the more seriously wounded Army casualties also were very adequately looked after at this excellent hospital and later transferred to a Canadian unit.

The reception of casualties at Newhaven was looked after by a main dressing station of the 8th Canadian Field Ambulance. Most of these came in small craft and were held until a hospital train was organized to take them on to Marsden Green. This was not part of the original plan but was made during the confusion of communications which arose on that day. However, it worked well and all the casualties were comfortably transported to 7th Canadian General Hospital.

The work of the medical officers and stretcher bearers of these forces can only be described as most excellent. Opposition on the beaches was severe, and injuries were many. Many wounded prisoners were left on the beaches as it was impossible to clear them, and there were numerous examples of heroism which were performed by medical officers and medical other ranks, chaplains and others, who all gave of their best on that day.

It is also desired to express the appreciation of the general hospitals who worked unceasingly, operating on casualties immediately on their arrival. Doctors, nurses and orderlies did not stop in their work until all casualties had been treated.

The experience gained in this raid taught the lesson of always being ready to change set plans in order to carry out an objective.

MAY 1943

## THE DIEPPE RAID

MAJOR F W HAYTER, R C A M A., M C

Security had been very well guarded, and certain of the final preparations were completed on board ship while crossing the Channel. All details of any importance concerning the operation were carefully passed down by company, platoon, and section commanders during this time. These included the proposed location of the regimental aid post, and method of further evacuation of casualties back to the ships.

The plan for clearing casualties from the South Saskatchewan Regiment was as follows. For the first three-quarters of an hour they were to be taken to, or near, the Pourville beach, where our regiment was to land, and then to be removed from there on to the landing craft which were to bring in the Camerons of Canada. After that the casualties would be cleared from the regimental aid post by one section of the 11th Canadian Field Ambulance, which was to land on the Dieppe beach.

beside me was shot through the head and also fell over us. Water was flowing in the front of the boat in a stream about two inches deep as the ramp was held down by the weight of wounded on it. This was eventually raised and then everything which was considered as any weight at all such as steel helmets, rifles and equipment, was thrown overboard in order to lighten the boat, also the man, now dead, who had fallen over me.

After going out some distance a larger landing craft was encountered and all those who were able to care for themselves were transferred to it. This still left us with a good full boatload of our own. Later we drew up alongside H.M.S. *Albrighton* and all personnel were taken on board. A naval medical officer there arranged for all the wounded to be taken to the various holds of the ship. Our casualties, along with those who had arrived previously, filled all available space - the tables, floors, hallways, and even the shelves along the sides of the hold. Dressings were then rechecked and morphine was given where required.

Documentation had been almost entirely neglected by me up to that time. I now helped to fill out the more necessary information on field medical cards for each of the wounded and collected a list of all those injured who were on board the ship. Several times I considered my list to be complete only to discover some small room or hold which had previously been missed with a few casualties in it.

We arrived in Portsmouth harbour at about 01.30 hours the following day and were met by sections from the 10th Canadian Field Ambulance, who had the destroyer cleared of casualties in record time. Those of us who were not injured were taken to a reception camp where cigarettes, lunches and rum or coffee were served then a few hours sleep and transported back to our regimental area.

I should like here to give great praise to the regimental stretcher bearers for their work and attention to the wounded during the raid. They were working under heavy fire and crossing areas without cover to attend the wounded and carry them back to the beach. Many casualties who were not considered to require further attention were taken directly to the beach, and those who were brought in to me had already received excellent care. The majority of casualties among the stretcher bearers occurred while they were carrying wounded across the beach, some when making repeated trips.

The general spirit of the boys throughout the battle was very high and in those who returned there was certainly no feeling of despondency, but rather that they had been in one of the first-class battles of any time and that they had done a good job and intended certainly to even up all scores when they next went into action against the Germans.



down the seven-foot drop on to the beach. They were then arranged along the base of the seawall which protected them from enemy fire.

Attempts had been made two or three times to bring an assault landing craft in to the beach to remove the wounded, but it was turned back by concentrated enemy fire which came from strong machine-gun and mortar emplacements on the cliffs at either end of the beach.

Casualties gradually became less frequent, and finally they had all been removed from the regimental aid post to the beach. Shortly before 11 00 hours my batman runner brought back word from battalion headquarters to close the present location and return to the beach, and that the companies would be notified to bring any wounded with them as they returned to re-embark. A number of German prisoners, both wounded, which I had previously attended, and unwounded, were near-by. I advised our intelligence interpreter that he should order them to move down closer to the beach. Those who were not wounded started to walk off in that direction, but were brought back by the very effective orders of the interpreter to assist their wounded companions.

In our machine-gun post at the beach I met Captain Brackman, medical officer to the Camerons of Canada, and had a short chat with him. We descended down on to the beach and prepared for the final evacuation of casualties to the assault landing craft as they arrived. Soon we saw four of them coming in, and as they neared the beach it almost seemed as though the water was boiling around them from the number of mortar shells which were exploding in their vicinity. Our casualties were carried across the beach by the stretcher bearers and any other personnel able to help carry or assist them, timing to cross the beach and reach the water's edge at the same time as the arrival of the landing craft. This was done under very heavy machine-gun fire from the headland positions at either end of the beach. Those wounded during the crossing were picked up by personnel crossing later. Many were wounded after embarking and were attended by their companions. I found out after I arrived back in England that Captain Brackman had been seriously wounded, and had been picked up in the sea while lying face down in the water.

More boats could now be seen coming in to the beach. My sergeant, another stretcher bearer and myself carried one of the casualties towards one of these landing craft. As it touched the beach and let down the ramp it was very quickly filled with men. The water was quite shallow, as the tide was not full, and it seemed to take about ten minutes under open enemy fire before the boat had been pushed out far enough to clear the beach. I climbed on board, lifted one man by the shoulders as he was being passed in, stepped back a few paces with him and tripped over a metal bar across the bottom of the boat. I fell back with the casualty on top of me and another was thrown half over him. I managed partly to raise myself when a chap standing

ture at Amiryra that they will never forget. In this lecture, Montgomery gave a detailed plan of the attack with full reasons as to why he had arrived at his decision. His manner and the delivery of his speech left no doubt in the minds of his listeners that defeat was possible, and he prophesied that after a fierce dogfight with the infantry the enemy would break within eight or ten days. In actuality, the attack started on October 23 and 10 Corps passed between 10 and 30 Corps to break through the enemy armour on November 4. The rest is well known - how Rommel's famous Panzer divisions were made to appear very ordinary cattle, and how the advance through the old familiar places, Daba, Fuka, Matruh, Sidi Barrani, Sollum, Bardia, Tobruk and later Derna, Barce and Benghazi took place. At this point, on November 28 30 Corps again went to the front, and Rommel was never in a position to do anything but fight delaying actions until he was flung back beyond Tripoli before the end of January 1943. Now to return to the medical aspect of the battle.

It was, of course, obvious that if the attack succeeded we should be faced with two long lines of evacuation, one along the north road and the other some 20 to 30 miles south, where the going was bad and for the most part over rough country studded with small hummocks of camel grass. The original attack necessitated the passing of the 1 and 10 Armoured Divisions through gaps in the minefields, made by the infantry of 30 Corps. It was therefore essential that only the minimum requirements of medical units should accompany the attacking forces, so sections of the light field ambulances accompanied each armoured brigade, with a small number of cars attached. The main dressing stations of the light field ambulances of the armoured divisions were situated just behind our own minefields, and in this way casualties reached field surgical units at field ambulances extremely early in the opening stages of the battle, whilst many early casualties found their way to the well-equipped main dressing stations of the infantry divisions of 30 Corps.

When the armoured divisions finally broke through on November 4, the number of casualties to be dealt with luckily decreased and an extremely rapid advance commenced. This necessitated divisional field ambulances making moves of 60 to 70 miles at a time with the medical units following on their heels. Moves of individual units of 200 miles were ordered and carried out without causing even a moment's comment. I would like at this point to digress, and to emphasize the greatest possible stress that these moves could not possibly have been carried out in time to receive casualties had it not been for the excellent communication. Before the beginning of the battle, D D M.S. Corps had a control set, with which he was able to communicate with the A.D.M.S. of the 1, 8 and 10 Armoured Divisions, the 2 N.Z. Division. He also had direct communication with the two light field ambulances, and with 15 G.C.S. and 8th South

JUNE 1943

## THE BATTLE OF ALAMEIN AND THE CAMPAIGN IN LIBYA

BRIGADIER Q V B WALLACE, C.B.E., M.C.

*D.D.M.S. 10 (Armoured) Corps, 8th Army*

Following the fall of Tobruk, the Germans advanced east along the coast to within 40 miles of the outer defences of Alexandria, and a very critical period in the history of the British Army in the Middle East followed. Rommel had reached the Alamein line and many thought he would continue his advance, perhaps splitting his forces, one part to attack Alexandria, and the other to make the hazardous trip across the desert via Wadi Natrun towards Cairo. History will no doubt show us later on that Rommel's increasing line of communication and his supply difficulties were the cause of his not being able to proceed any further than Alamein. The situation at this time, that is to say, the end of July, 1942, was so grave that definite schemes for the evacuation of base units in Egypt to Palestine, Suez and the Sudan were hurriedly prepared and refugee and military roads were marked throughout the Delta. This phase lasted for a time, but with news of more tanks and reinforcements, the whole picture changed. All defensive ideas were swept aside, and before September it was obvious that General Montgomery was forming a concrete plan to attack the Alamein position at some future date. The Axis forces had made a final attempt to penetrate our armour in the south of the Western Desert round about the beginning of September, which threatened to interfere with, or at least delay, Montgomery's plans.

At this time the line was held by 30 Corps on the coastal sector, and by 13 Corps in the south. The interesting point about the planning of the Alamein battle was the complete reversal of previous tactics. Previous operations had always involved attacking the enemy's infantry with our armour, our infantry divisions then attacking to destroy the enemy infantry; but at Alamein, Montgomery attacked all along the northern sector with the infantry of 30 Corps, and kept a complete armoured corps, the 10 Corps (consisting of 1st, 8th and 10th Armoured Divisions), ready to pass through the infantry and to keep the enemy armour at bay, whilst our infantry tore the guts out of the enemy infantry, after which our armoured forces broke through to destroy the enemy armour. When it was realized that this battle was to be on a three corps basis, D.D.M.S. 8th Army decided that the existing medical units of 30 Corps in the north and 13 Corps in the south would be sufficient to deal with casualties during the first phase of the battle, i.e. while the Allied infantry attacked the Axis forces. The Alamein

back to A.D.M.S. thence to Corps and Army is of the utmost importance. It is only when this information is available that Corps and Army are in a position to anticipate future moves, and so keep a line of evacuation forward enough to avoid congestion in M.D.S.s. On several occasions in this campaign, C.C.S.s and field ambulances received casualties within an hour of being ready to receive them, whilst in one case casualties arrived on the doorstep of the building at the same time as the medical unit appeared round the corner. Officers commanding field hygiene sections were used for this purpose as liaison officers. These officers were well trained in map-reading and had before the battle contacted A.D.M.S. and field ambulance commanders. They were mounted in jeeps, and it often took them twenty-four hours each way to reach D.D.M.S. 8th Army. Similarly they brought information to corps from divisions, which could not be sent over the wireless.

There were, of course, many other details to be arranged before October 23 the day of the attack. These may now briefly be discussed.

*First-aid outfits for armoured fighting vehicles* - Every tank and armoured car whether of British or American manufacture, is fitted with a special first aid outfit. It is essential to check all these first aid outfits before battle and to place in each outfit either tubercle morphia or croquettes. It is of course, unnecessary to state that armoured regiments require that 100% officers and men are properly trained in first aid (King's Regulations, para 816 (a)).

*Water* - The ration of water in the Western Desert is one gallon per man for all purposes, including cooking, washing, shaving, etc. Yet the experienced desert rat finds no difficulties on one gallon, and on many occasions has carried on with half a gallon for considerable periods. The added factor that between Sollum and Agheila nearly all the water is saline in varying degrees adds to the general entertainment. Saline water though it makes tea unpalatable and whiskey nearly undrinkable - but not quite - has never been a source of sickness in the Western Desert. At Capuzzo in 1940 water of a salinity up to 700 gm. was drunk, the Italians having pumped sea water from Bardia through the water supply pipes. This saline water was gradually diluted by fresh water brought in water tank companies, and the situation became easier. In 10 Corps, arrangements were made during all operations that extra water rations were available for medical units up to the following limits

*Daily extra issue*

R.A.P.	5 gallons	M.D.S.	100 gallons
A.D.S.	20 gallons	C.C.S.	200 gallons

*Red Cross stores* - These were supplied from the Red Cross organization in Cairo and the assistance given by them has been of the greatest help. They provided medical units with wireless sets, games, eating

African C C S As 1 N.Z C C S (light section) had no wireless, this unit was attached for most of the battle to 151 Light Field Ambulance. This choice proved lucky, as 151 Light Field Ambulance was capable of rapid movement, and could at the same time, by means of the light section of the 1 N Z C C S, provide surgery at a very early date.

The three field surgical units were attached to C C S s and one surgical unit was attached to a light field ambulance in the 1 Armoured Division, but it turned out that the moves of this ambulance were so frequent and so rapid that very little surgery could be done, and I consider that field surgical units can best be made use of in an advance with either main dressing stations or field ambulances, or better still, with C C S s, providing always that the C C S s are moved as far forward as possible. No 7 Blood Transfusion Unit was responsible for delivering whole blood and plasma to field ambulances and C C S s wherever required within the corps. During the first few days of the battle, whole blood was used for transfusions at an alarming rate and perhaps it was lucky that heavy casualties did not continue at the original rate, or there would have been little blood left amongst the troops in the Delta. At one time, the supply of donors was severely threatened. However, the situation has now been modified, and it is hoped that surgeons will limit blood transfusions to those who really require this treatment. Each light field ambulance has now 20 ambulance cars whilst an ordinary field ambulance has only eight, which has now been increased to 12 during operations in the Western Desert. In view of the fact that rapid evacuation must be the keynote of all successful medical evacuation in battle, it is obvious that this success must depend on the most efficient use of all ambulance cars available. The custom of attaching at least two ambulance cars before the beginning of the battle to each regiment has a great deal to be said in its favour. It saves sending back in the first case to an advanced dressing station for cars. Furthermore, the drivers of these ambulances know where the regimental aid post is, and it is important that these cars should not go further back than the Brigade A D S, for this reason. The drivers of these cars become very attached to their own regiments and can be relied upon to complete the journey from R.A.P. to A D S and *vice versa* if it is humanly possible under any conditions. The distances to be traversed between advanced and main dressing stations were colossal, sometimes hundreds of miles. In this connection I may say that the supply line (which is also the line of medical evacuation) from Alexandria to Tripoli represents London to Moscow, with London as a base, and a single tar macadam road connecting them. All the more credit then that hardly a complaint has been received, whilst all the other branches of the Army have heaped congratulations on the evacuation of casualties in the Western Desert in each succeeding campaign.

The value of early information being passed from field ambulances

During the advance, one of our liabilities was the evacuation of enemy casualties. The first were met at a small German field hospital near Garawla, some 20 miles this side of Mersa Matruh – about 60 of them. They were very well supplied with food and medical comforts, and the latter were used by us after the evacuation of the patients. They were evacuated by road to Daba and from there by ambulance train. A German doctor had been left with the patients. At Mersa Matruh there were about 400 patients in the old Egyptian barracks, there being an equal number of Germans and Italians. These could not be dealt with immediately, and were later evacuated under Army arrangements. The enemy evacuated most of his casualties early and luckily no great numbers were met with but there were a few of our own wounded in the colonial hospital Benghazi as well as some Axis sick and wounded. One Captain Allen R.A.M.C., had managed to get himself left at the colonial hospital as a patient. He was originally captured at the fall of Tobruk, when 62 General Hospital commanded by Colonel Davy was lost *in toto* with the exception of the sisters who were evacuated from Tobruk four or five days before its fall. Captain Allen had done extremely good work, and was much praised by our wounded and sick whom he had looked after. The colonial hospital was taken over temporarily by 131 Field Ambulance but owing to its position etc. all Allied patients were evacuated and it was not again occupied by an R.A.M.C. unit until the arrival of 58 General Hospital at the end of January. During this interval the hospital was fortunately occupied by the R.A.F. with 22 M.R.S. and they very kindly held Army cases awaiting evacuation by ship from Benghazi overnight. 10 Corps medical units at this time were at the hospital area outside Benghazi, at Barce, Derna, and Tobruk a mere 300 miles between them. It is hoped that such distances will not be necessary in any future campaign but already I see a long single line looming in the distance, from Benghazi via Tripoli, into Tunis, something over 1 000 miles.

utensils, mugs, etc., as well as treasure bags containing small kit for the casualty who usually arrives at the A D S with nothing but what he stands up in.

*Reinforcements* - Owing to the extremely rapid moves of medical units, R A M C reinforcements were sent up through medical channels, and not as laid down in field service regulations. A D M S signalled their requirements to D D M S Corps, and all R A M C reinforcements available were allotted by D D M S 8th Army. With regard to officers, when it is realized that 10 Corps alone had over 250 R A M C officers in it on October 23, 1942, replacement of officer casualties from enemy action and sickness became an important matter. By some method or other, Middle East headquarters kept the 8th Army well supplied in numbers, but it is regretted that many who came up were, through lack of training, quite unsuited for immediate duty with a field force, and had to go through the hard school of experience in the desert.

*'Pep' tablets.* - It is of interest to point out here that 'Pep' tablets, i.e. benzedrine tablets, were used for the first time in the Middle East on a large scale. 20,000 tablets were issued to the A D M S of each division (100,000 in all), who was responsible for their distribution and safe custody. The initial dose was  $1\frac{1}{2}$  tablets two hours before the maximum benefit was required, followed six hours later by another tablet, with a further and final tablet after another six hours, if required. Each tablet contained 5 mg. I consider that 'Pep' tablets may be very useful in certain cases, particularly where long-continued work is required over extended periods, i.e. staff officers, signallers, lorry drivers, transport workers, etc. The tablets must only be used when a state of extreme tiredness has been reached. The tablets have practically no ill-effects, and an ordinary night's sleep restores the individual to his original working capacity.

*Blood transfusion.* - All medical units held M.E.F. scale. Whole blood was available at the advanced blood bank, which moved with an R.A.F. M.R.S., and blood arrived by plane from Cairo. F.T.U.s also held a small reserve of apparatus, and lived with one of the Corps C.C.S.s, and did extremely good work.

*Medical supplies* - All field medical units carried fourteen days' reserve expendable medical stores. Field ambulances and light field ambulances are well supplied with load-carriers, and providing these lorries are not used improperly for additional officers' messes, sergeants' messes and canteens, etc., there should be no difficulty in carrying required supplies. Officers particularly accumulate items of extra comfort, and many officers' kits reach four to five times the normal allowance in the desert. Officers have suffered in losing their kits by enemy action, as only certain items are recoverable from the Government, and although I have not practised what I preach, I would advise officers to keep themselves down to an absolute minimum.

The officer survivors messes in the fairly palatial saloon together with the ship's officers.

Under my charge was a large store of clothing and comforts. These had been contributed by the numerous charitable concerns such as the Red Cross, the W.V.S. and the National Sailors Society. There were a hundred complete outfits of shoes, underclothes, trousers, sweaters, caps and coats as well as large amounts of knitted comforts, tooth brushes, shaving gear, towels, books, dart boards, etc. Last but not least there was a very adequate supply of cigarettes and naval rum—the issue of the latter I am pleased to say was one of my less arduous duties.

There were two cranes forward in the well-deck from which could be swung large baskets that were capable of carrying two men. These were swung outboard and lowered into lifeboats containing wounded men who were then hoisted inboard fairly easily. Rescue nets were fitted along the ship's sides which could be lowered into the sea enabling the survivors to scramble aboard. Other rescue nets were fitted to booms near the bows of the ship, these could be swung out well clear of the ship's side so that the nets were at right angles to the ship. These proved very successful, as before they had been fitted men or boats in the water ahead of the ship were washed out away from the ship's side by the bow wave, which is very powerful even when steaming dead slow and quite a number of men had been lost in this way. There were also many life-belts, heaving lines and ropes that could be thrown to men in the sea.

Adequate numbers of lifeboats and rafts were carried to accommodate 150 survivors as well as the ship's company should we in turn be unlucky. We also had a 22 ft. motor lifeboat which could be sent away to pick up men in the sea. Occasionally we had to let go a raft as we passed a group of survivors in the sea so that they could hang on to it before we returned later to pick them up. This was not encouraged of course, as it depleted the total life-saving gear.

The ship was manned by merchant seamen and officers, of whom there were about fifty. They were specially selected for manning the motor lifeboat, and were mostly expert seamen from the Hebrides, used to manning small boats. In addition there were some twenty naval and military gunners and a gunnery officer. There was one S.B.A. and myself.

The hospital had six fixed cots and was situated just beneath the bridge and was originally the passengers' lounge. It was quite adequate and well equipped. When patients overflowed from this they were either put in the officers' cabins or in bunks on the survivors' deck.

The operating theatre consisted of a small cabin built alongside the hospital on the boat deck. It was fitted with a wooden fixed operating table with a rubber mattress, to which straps were attached so that the operator and assistant could strap themselves and so avoid



JUNE 1941

CONVOY RESCUE SHIPS<sup>1</sup>

SURGEON LIEUTENANT R D WILKINS, R N V R

Until recently convoy rescue ships were on the secret list and naval officers had no opportunity to gain knowledge of them

I was very fortunate in serving in one of these ships during the autumn and winter of 1941 until the spring of 1943, and found the work extremely interesting, both because of the surgical cases one saw and from the opportunity afforded in seeing the battle of the Atlantic and Arctic convoys through the eyes of the merchant seamen

A rescue ship is a converted merchant ship which has been fitted with life-saving apparatus, accommodation for survivors and a small hospital. My ship was a small coast-wise cargo ship in peacetime whose trade was carrying cattle, and in the summer months it carried up to thirty passengers in addition between the Clyde and Northern Ireland

The duties of rescue ships are, first, to pick up survivors and, secondly, to act as hospital ships for the convoys. Thirdly, and possibly the most important, was their role in keeping up the morale of the merchant seamen in the convoy, who knew that there was a ship whose specific duty was to pick them up at all costs

The cattle deck had been converted into survivor accommodation. This consisted of a large compartment amidships fitted with about forty bunks, and with mess tables and benches. There were a further fifty bunks fore and aft on the same deck round the sides of the engine room. The old passenger cabins were fitted with two bunks each for survivor officers. This brought up the bunk accommodation to about 100. In addition there was a large number of mattresses and bedding so that any further survivors could be accommodated on the deck

We were fitted and provisioned to carry 150 survivors in all, but, of course, could carry more, as indeed we did when the necessity arose. Shower baths, heads and a wash-place with some twenty basins had been fitted on the survivors' deck.

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We were fitted and provisioned to carry 150 survivors in all, but, of course, could carry more, as indeed we did when the necessity arose. Shower baths, heads and a wash-place with some twenty basins had been fitted on the survivors' deck.

There was a large refrigerator which carried fresh food for the ship's company and some was always available for survivors. There were in addition large stores of tinned and dried foods, mainly bully beef, dried peas and biscuits, on which we had to fall back if there were many survivors. The galley was on the survivors' deck, and we carried extra galley staff to cope with the cooking, also volunteers were always forthcoming from among the survivors to help with such tasks as peeling potatoes, washing up and carrying food to the mess tables.

<sup>1</sup>Reprinted by kind permission of the Editor of the 'Journal of the Royal Naval Medical Service.'

is useless. There was no sound I have heard more unpleasant than voice shouting for help out of the pitch blackness when one was able to see him and pick him up and I am afraid many men succumbed to exposure in the icy seas before we reached them.

It was obviously asking for trouble to turn on a searchlight casually however this risk was taken. It was at night time that the rescue boat came in most useful. It was able to cruise around while we were stopped and being so low in the water was able to see men swimming about much more easily. In day time rescue work usually took about two hours, and when we were satisfied that no more survivors were in the sea, we steamed back at full speed, which to the escort must have seemed dead slow to join the convoy. By this time it was a considerable distance ahead and we sometimes had difficulty in finding it.

It was at this stage that the medical officer's real work began. The survivors were all mustered in the saloon and given a large tot of rum. The injured were kept in the saloon until they had been sorted out and were given morphia if necessary. The men were all taken below and their bunks allocated. Any of them who had been in the water and had wet clothing were stripped, put under hot showers to wash off the fuel oil and then warmed up in between blankets with hot-water bottles. Hot cocoa was usually ready and issued as soon as the survivors were on board. Many of the survivors came aboard in very inadequate clothing or even with none at all. These men, together with those who had been stripped were all taken down below and issued with full sets of clothing and comforts at once.

The men were organized into working parties, under the charge of one of their own officers if possible, to keep their quarters clean and to do various other galley duties. Games and cigarettes were issued and everything done to keep up morale. A great tendency has been found in the survivors to rush up on deck at the least explosion and this had to be discouraged as much as possible as they often obstructed the ship's company running to action stations. Some survivors would not come down below at any cost, and in one particular convoy forty or fifty survivors never used their bunks at all, and even on the coldest nights were to be found huddled together on the boat deck, where they remained until we dropped anchor in Scotland ten days later. This was not altogether a bad thing as we had on this occasion picked up survivors, far exceeding our bunk and mattress accommodation. I was very worried at this time as there were some thirty stretcher cases who could not have walked to the boats. I was afraid that should we be unlucky enough to get hit ourselves the survivors on the boat deck, and particularly the few natives, would panic and rush the boats before I was able to get my patients into them. As it was, one raft was let go by an hysterical survivor when there was a particularly loud explosion near by and some survivors jumped into the boats. Luckily they were prevented in time from letting go the falls.

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A rescue ship is a converted merchant ship with life-saving apparatus, accommodation for survivors, and a hospital. My ship was a small coast-wise cargo ship whose trade was carrying cattle, and in the summer months carried up to thirty passengers in addition between the United Kingdom and Ireland.

The duties of rescue ships are, first, to pick up survivors and to act as hospital ships for the convoys. Their second, and most important, was their role in keeping up the morale of the seamen in the convoy, who knew that their only hope of survival was to pick them up at all costs.

The cattle deck had been converted into a hospital. This consisted of a large compartment with forty bunks, and with mess tables and benches. There were fifty bunks fore and aft on the same deck. The old passenger cabins were fitted up for the survivors. The old officer's cabin was for the survivor officers. This brought up the total to 100. In addition there was a large number of blankets so that any further survivors could be accommodated.

We were fitted and provisioned to carry 100 survivors. Of course, we could carry more, as indeed we did. We had shower baths, heads and a wash-plait. A wash-plait had been fitted on the survivors' deck.

There was a large refrigerator which was supplied by the company and some was always available. In addition large stores of tinned and dried peas and biscuits, on which the survivors lived. The galley was on the main deck with extra galley staff to cope with the work of the survivors. The forthcoming from among the survivors was peeling potatoes, washing up and

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sole of a man's boot with a hole in it to carry a piece of extension rope. This was satisfactory for a day or two until the pressure on the dorsum of the foot caused a lot of pain, so this was changed to a plaster spica. In another case the ingenuity of the chief engineer was called upon and he made me an excellent Steinmann's pin from a length of steel packing picker. A combination of fixed and balanced traction was used with a Steinmann's pin through the tibial tuberosity. The ship's carpenter had made a satisfactory Balkan beam, and the deck department provided the blocks and tackle.

Burns and scalds also gave trouble, as it was very hard to maintain complete asepsis if a large area had to be towelled off, especially as we were using towels that had been boiled and had to be wrung out. After cleaning up thoroughly with soap and water second degree burns were treated with Triofax jelly. Third degree burns were treated with sulphanilamide powder and tulle gras dressings soaking them off daily in saline baths.

These methods gave quite good results, and there is one case that will always stand out in my mind. He was a magnificent physical specimen, a stoker petty officer. He was sleeping over the engine room in one of H.M. ships that was torpedoed in the engine room. He had second degree scalds of his face, trunk, arms and third degree scalds of his hands. He was blown into the sea which was at a temperature of 29 F. and swam nearly a mile to one of H.M. trawlers. Three or four hours later I went over in the motor boat to bring him back aboard my ship. He was naturally very severely shocked, but responded to large plasma transfusions, and was treated, when sufficiently recovered, by the method already described. I am pleased to hear that he walked out of Chatham Hospital to duty not very long ago.

The second duty of rescue ships, namely the work of hospital ships for convoys, provided some interest. It is fairly natural that with thirty or forty ships or even more in convoy, there should be some sickness. On the average there was one acute abdominal emergency every other trip. When we received a signal that a ship had a sick man aboard we used to steam up alongside as near as possible, and using the loud hailer we attempted to get some sort of history. If I thought that the condition was not serious or that it just required medicine this was fired over to the ship with a rocket and line apparatus. If, however, it sounded more serious I went away in the motor lifeboat aboard the ship to examine the patient. This was often quite a hair-raising experience in the Atlantic with big seas running. The superb seamanship of the crew and officer in charge saved us on many occasions. When coming alongside a large ship one moment the motor boat would be level with the boat deck and the next looking at the keel. Often I arrived at the top of the ladder looking and feeling worse than the patient, but fortunately the hospitality was

being thrown about by the ship's roll. There was an electric sterilizer, an electric water boiler and a wash basin. This room also contained the medicine cupboards and was used by me for seeing patients at sick parades. Heat was provided by steam heaters and a quite high temperature could be maintained. A full set of operating instruments, P O P splints, dressings, plasma, electric blankets and hot-water bottles were carried.

At sea the rescue ship took up her position in the convoy. There was nothing to distinguish her from the other merchant ships. No Red Cross signs were displayed, and for protection she relied on her excellent armament.

When a ship was torpedoed in daylight, we steamed out of line, hoisting a special signal so that other ships steered clear of us, and closed with the sinking ship as fast as possible. This usually took only a few minutes, meanwhile the convoy and escort steamed on ahead leaving one escort vessel if possible to give us some protection. When we had approached as near as possible we stopped with our rescue nets down and picked up the men from the lifeboats and rafts. There was an electric loud-hailer and microphone on the bridge, and instructions were given to men in the sea and lifeboats to get alongside as soon as possible; for during the time we were stopped naturally we were a sitting target. On the whole, however, enemy U-boats did not attempt to molest us though we sometimes saw them for a brief moment on the surface, especially at night-time in moonlight. Other rescue ships have not found the U-boats so amicable and have been torpedoed while doing their rescue work. Enemy planes were very different, and it was then that we were very glad of our armament.

If there were many survivors in the sea who had not managed to get into lifeboats or rafts we lowered our motor-boat and the rescue crew went away to pick them up. The boat was sometimes taken away in terrible weather, and because of the monotonous breakdown of the small petrol engine, the sweeps had to be used on almost every occasion. This feat will be appreciated by all those who know the North Atlantic in winter time. When our boat was back and hoisted inboard again, and all the survivors had been picked up from the lifeboats and rafts, we started slowly among the wreckage making a thorough search for any and <sup>as a last</sup> ~~any~~ <sup>and</sup> ~~son~~ <sup>ing</sup> survivors. One of the chief difficulties experienced was to get men inboard from the sea who were covered with sea and biscuit. <sup>ad</sup> ~~ad~~ <sup>ad</sup> to climb down the rescue netting with heaving lines. The <sup>g</sup> ~~g~~ <sup>g</sup> the line round their chests. Lately a life-belt has galley staff to cope <sup>has</sup> ~~has~~ <sup>has</sup> a rope loop fixed in the back so that a man coming from among <sup>a</sup> ~~a~~ <sup>a</sup> be hooked up easily. Dig potatoes, washing <sup>the</sup> ~~the <sup>the</sup> work was much more difficult. Most merchant ships printed by kind permission of <sup>electric torch with a red bulb which clipped</sup> ~~life-jackets, this helped to show where they~~ <sup>often it became covered with fuel oil and</sup> ~~al Service~~~~

sole of a man's boot with a hole in it to carry a piece of extension rope. This was satisfactory for a day or two until the pressure on the dorsum of the foot caused a lot of pain, so this was changed to a plaster spica. In another case the ingenuity of the chief engineer was called upon and he made me an excellent Steinmann's pin from a length of steel packing picker. A combination of fixed and balanced traction was used with a Steinmann's pin through the tibial tuberosity. The ship's carpenter had made a satisfactory Balkan beam, and the deck department provided the blocks and tackle.

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Survivors who came aboard and showed signs of hysteria were given morphia gr  $\frac{1}{4}$  at once, and this was found to be very beneficial. Lat on a potassium bromide mixture was administered liberally.

Now to return to the injured patients. The most seriously injured were taken to the hospital at once, and the less serious were given bunks below. The commonest injuries were compound fractures, head injuries and burns and scalds. Shock was treated by heating with either electric blankets or hot-water bottles, morphia gr  $\frac{1}{2}$  and plasma transfusions were given when necessary. The latter was sometimes rather difficult as the ship might be rolling through 20 to 30°, but on the whole we managed fairly adequately. Those cases that required operation were selected and taken to the theatre. This was got ready by my S B A and entailed a rather complicated procedure.

The sterilizer was not large enough to hold basins and there was no autoclave, so that the galley steam-boiler had to be used. All the basins, towels, swabs and gloves were taken down two decks to the galley and boiled. They were then carried back again up to the theatre. Altogether not a very satisfactory process, but luckily there was very little sepsis. When the patient was prepared I induced the anæsthetic. For short operations pentothal was excellent, but for longer operations open ether with the 'rag and bottle' method was used. More recently an Oxford vaporizer was provided and proved a most excellent machine, necessitating the minimum of attention from me, the single lever control being easily worked by an untrained assistant. After induction I handed over to an assistant and began to scrub up myself. I was very lucky here as both the second and third mates were very keen. The second mate had been a fourth year medical student seven or eight years previously, and whether by his own choice or the decision of the examiners - I am not sure which - decided to give up medicine to go to sea. He proved a most excellent assistant. The third mate was qualified as an anæsthetist by virtue of having sold patent medicines before the war and also was a ready pupil. My S B A acted as theatre sister. He was of more doubtful value, having done one month in a naval hospital before being sent to my ship, his previous occupation was an assistant in a Scotch whisky distillery. He was a better dispenser than theatre sister.

Fracture work was the easiest with which we had to deal, as we had a plentiful supply of P.O.P. and I was not as greatly hampered by lack of X-ray as I had expected. The Winnett Orr or Trueta method of treatment for compound fractures was employed. We were fortunate also in having good stocks of sulphanilamide powder. Fractures of the femur were a more difficult problem. The application of a plaster spica was out of the question if the ship was moving with a fairly heavy roll, but in calm weather it was done. Thomas's splints were also used. There was no proper skin traction elastoplast so other methods had to be devised. In one case the engineers welded a piece of iron into the

THE SICILIAN CAMPAIGN MEDICAL  
PLANNING

MAJOR-GENERAL SIR PERCY TOMLINSON

R.E.F., C.B., D.S.O. F.R.C.P., R.M.P.

*D.M.S., 21 Army Group*

As D.M.S. M.E.F. I was responsible for the medical arrangements for General Montgomery's 8th Army. The responsibility for the whole medical arrangements rested with the D.M.S. Allied North African Force, as the 8th Army passed to their control as soon as the expedition was launched.

## BROAD PLANNING

G.H.Q. M.E.F. decided (1) to establish a large base at Tripoli, being the shortest sea route between Sicily and Middle East, (2) to increase the number of hospitals in Malta, though this island had been disallowed as a midway base by the C. in-C. Mediterranean and (3) to have general hospitals, convalescent depots, base depots of medical stores packed ready in Egypt for transportation to Sicily and later to Italy.

The broad medical planning was based on the following:

(1) *The Commander's plan.* - (a) To attack the south-east corner of Sicily by four assault divisions, an independent assault brigade, an air-borne parachute division (to attack the main aerodromes by brigade groups) two armoured brigades, and two follow-up divisions. A total of about seven divisions as a round figure to work on (b) to capture the port of Syracuse early as a main base, with possibly Augusta as a subsidiary base.

(2) *The General Staff's estimate of casualties was high* namely 25% of assault force on the 1st day 10% of assault force on the 2nd day 8% of assault force on each of the 3rd and 4th days 4% (sick and casualties) on the 5th to 15th days.

This high estimate shook us, as the scale of possible ships for transportation of general hospitals to Sicily was low and that meant the C.C.S.s being filled beyond capacity unless air-evacuation was established early.

(3) *The number of follow-up convoys their size and date of sailing* - Medical asked that (a) in assault convoys beach groups and field ambulances should travel, (b) in first follow up convoy C.C.S.s (c) in second follow up convoy one M.A.C. and all 200-bed general hospitals (d) in early follow-up convoys further C.C.S.s M.A.C.s, A.D.M., stores, field hygiene sections, 600-bed general hospitals.

always excellent, and one was usually met on deck with a large tot from the captain's best bottle

The cases were varied; one case was a Greek captain with acute bacterial endocarditis, who died on arrival in Canada, but most of the serious cases were the common abdominal emergencies. We brought back the patients that required operation to my ship as the facilities were so much better. Naturally conservative treatment was employed as much as possible, but the Oschner Sherrer treatment for appendicitis was not often successful, possibly due to the large amount of movement in the ship. There were many fruitless journeys, and the patient wanted little more than the assurance that there was a doctor present. One case I have in mind particularly was that of a captain of a ship on a Russian convoy. Just after a rather brisk attack and while I was coping with survivors, he signalled that he had acute pain in his right lower abdomen. I put him on half-hourly pulse and temperature chart, and after four hours he signalled the results back. His pulse had gone from 80 to 100 and his temperature was 99.5° F. I thought he sounded like the genuine appendix so went over for him in the motor-boat, thereby risking his ship and my own as we had both to stop until he was safely back on board my ship. When he got back on board he was examined - his temperature was normal, his pulse 70, and it was possible to push one's fist down to the posterior abdominal wall in the right iliac fossa without causing any pain. I had difficulty in resisting the temptation to take out his appendix when we reached the safety of land-bound waters.

On another occasion we received a signal that one ship had a mad-man aboard. About five minutes later we received a signal to do something quickly as he was armed and was attempting to set fire to the ship. I must say I viewed this with great trepidation. I visualized myself coming alongside in the motor-boat and offering a good and not easily missed target for this maniac. Luckily, however, one of the escorting destroyers raced alongside and sent an armed guard aboard and rapidly transferred this man to the cells.

Dentistry was another job to which one had to turn one's hand; it is surprising how many men in the merchant service go to sea with the most appalling mouthful of carious teeth. Here again the chief engineer excelled himself and made me a pair of beautiful elevators, which we copied from those of a dental officer aboard a depot ship.

Rescue ships afforded a most interesting and varied life. Despite tedious days of boredom there were many moments of intense excitement. When work came our way it came in such quantities that it was almost impossible to cope with it, but I feel that the experiment of adding these ships to convoy fleets has amply justified itself, not only in the many hundreds of survivors who have been saved, but also in helping in no small degree to maintain the excellent morale of our merchant seamen.

air evacuation centre, it is thought, proved its value at this aerodrome.

At this time, the 8th Army troops were fighting on the edge of the Catania Plain and the aerodromes of Lentini and Francesco became available for casualty air evacuation. The Australian air ambulance unit moved to Francesco and ran a shuttle service between Francesco and Cassibile, with the patients being held in No 322 Wing Casualty Air Evacuation Centre, and evacuated both by air ambulance and returning air transport. This half hourly shuttle of the air ambulance linked up with the air transport centre which had moved to Cassibile. The journey by air from Francesco to Cassibile was approximately twenty to thirty minutes and the journey by road ambulance approximately four to five hours due to demolitions and congestion on the roads. Thus the same principle held good - that the air ambulance shuttled between the forward areas and the air transport centre. This shuttle enabled some 2 500 casualties to be brought from the forward areas to link up with aircraft that were returning to the mainland. Congestion in the forward areas was relieved and similarly the congestion of the port of Syracuse was lessened.

For some reason the hospital ships which were expected to arrive did not do so for some four days, and the whole of the load of casualty evacuation was carried by air.

This organization would not have been possible if casualty air evacuation centres had not been formed at the wings, and after a few days C.C.S. commanders realized that they could clear their C.C.S.s expeditiously by using returning aircraft.

Before the fall of Catania, some 8 000 casualties had been evacuated by air ambulance and returning air transport aircraft - a good proportion of these going to Tripoli, a smaller proportion to Tunis and about 900 to Malta.

On each of the base air transport aerodromes, i.e. El Alouina (Tunis) Castel Benito (Tripoli) and Luqa (Malta) there was a C.A.E.C. These centres received patients from the forward areas and also evacuated backwards by returning air transport, i.e. from Castel Benito to Cairo from Malta to Tripoli and Tunis and from Tunis to Algiers. Thus cases were evacuated by easy stages from the forward main dressing stations and casualty clearing stations right back to the base hospitals 1 000 to 1 800 miles away.

After the fall of Catania and the evacuation of Sicily by the enemy the air ambulance shuttled between Milazzo and the advanced air transport centre which had now moved to Catania main aerodrome and gradually as hospitals were established in Catania the cases were held there.

During the planning for the invasion of Italy wing casualty air evacuation centres were again briefed and at the moment of writing cases are coming in on returning air transport aircraft from Salerno Bari, Taranto and Foggia.

every one of the forward aerodromes. The aerodrome occupied by the fighter wing normally housed four to five squadrons. By combining the medical resources of the squadrons comprising the wing and wing headquarters personnel, the casualty air evacuation centre and wing sick quarters was produced. This sick quarters had its own cookhouse and was fully equipped to feed and house some 40 patients in the holding unit.

The functions of the holding unit on the aerodrome were as follows:

- (i) To hold patients at or near the aerodrome according to the degree of air superiority. Thus allowing the principle that patients must await air transports, aircraft cannot await patients.
- (ii) To make these patients fit for air evacuation, i.e. give blood and plasma transfusions, and fluid and food.

Whilst the Western Desert Air Force was re-equipping for the Sicilian campaign and situated along the sea from Ben Gardan to Tripoli, several practices of air evacuation schemes were organized. As a result of these practices, individual medical personnel of each squadron were moulded together into an efficient wing medical organization.

The object of having a casualty air evacuation centre on each and every aerodrome was to ensure that wherever air transport might land, there they would find a casualty air evacuation centre holding sufficient patients to fill two aircraft.

The first aerodrome to be occupied in Sicily was that of Pachino (south-east tip) and No. 244 Wing Casualty Air Evacuation Centre was sited at this aerodrome. Unfortunately, the Army medical unit which was working in the vicinity did not realize the possibility of evacuation of casualties by air and in spite of the endeavours of the senior medical officer of the wing, comparatively few cases were got away from this aerodrome. When No. 244 Wing moved to Cassibile, some 30 miles north and a few miles south of the Port of Syracuse, the senior medical officer of the wing briefed casualty clearing station commanders in the medical area of Syracuse, and in the space of some five days over 800 Army casualties were evacuated from Cassibile to Tripoli (Castel Benito), to Tunis (El Alouina), and to Malta (Luqa). Again, some of the casualty clearing station commanders did not realize the importance of giving shocked patients resuscitation prior to air evacuation though this was soon remedied as they became more experienced in selection of cases.

The advance surgical team of No. 21 Mobile Field Hospital was therefore placed in close proximity to No. 224 Wing Sick Quarters to act as surgical cover and several gravely ill patients were held by them and not evacuated until such time as their condition warranted their being moved. The placing of a surgical team to work with a casualty

they draw on C.C.S.s, but in this instance they were ahead of the C.C.S.s, and so obtained their patients from the main dressing stations.

At first, these main dressing stations did not appreciate the type of case that could be carried by air. They did not realize that these transports were returning to base in any case and therefore it was economical to fill them up with any casualty that was fit for evacuation. These cases were evacuated to Catania in Sicily. The link of Catania to North Africa gradually dried up as the air transport squadron based in Tunis moved to Catania while the squadron at Catania moved to Bari.

An illustration of how wide the net has spread: a weekly return of the casualty air evacuation centre operated by No. 25 Mobile Field Hospital at Catania is appended (Appendix). It will be seen that casualties are arriving from the east side of Italy, from the toe of Italy and from the west side of Italy on returning air transport. These same casualties are admitted to hospitals at Catania and also evacuated from Catania to North Africa by aircraft which are bringing stores and personnel to Sicily.

The principles have again survived two distinct complete operations – that of the invasion of Sicily and that of the invasion of Italy. Both lines of evacuation, from the heel of Italy and from the Salerno area, have been operated by returning air transport aircraft to the casualty air evacuation centre sited at the advanced and air transport centre i.e. Catania.

Provided that hospitals and C.C.S.s are sited near aerodromes on which air transport land both from the forward and base areas, and provided that a holding unit is placed actually on these aerodromes then a very large load of casualties will always be transported by the returning air transport aircraft.

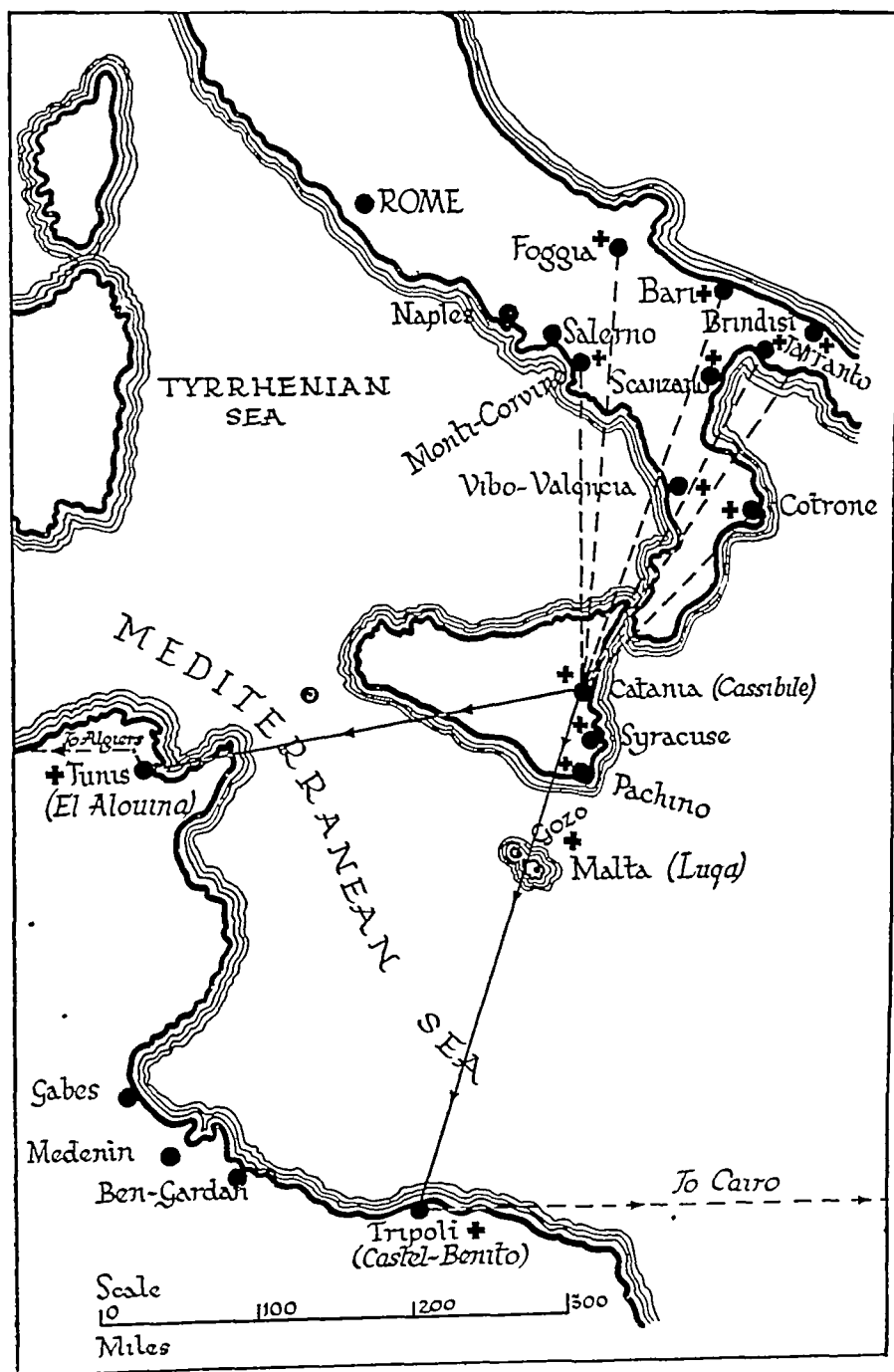
The whole organization is conditioned by the presence or absence of air superiority. With complete air mastery it is a safe operation. With relative air superiority there is a danger of losing air transports or having the advanced aerodromes bombed.

At the moment 100% safety is still expected from air evacuation and any disaster befalling air transport carrying casualties puts the organization back six months – as occurred in the early days of the Crusader campaign in 1941.

Such was the degree of air mastery that not one single casualty was lost either by enemy action or by an accidental crash landing from Alamein until the capture of Foggia in October, 1943. Over 20,000 casualties were carried by the Australian air ambulance unit working the forward areas linking with returning air transports.

This organization could not have been built up without the co-operation of all the various cogs in the machine. The air transport

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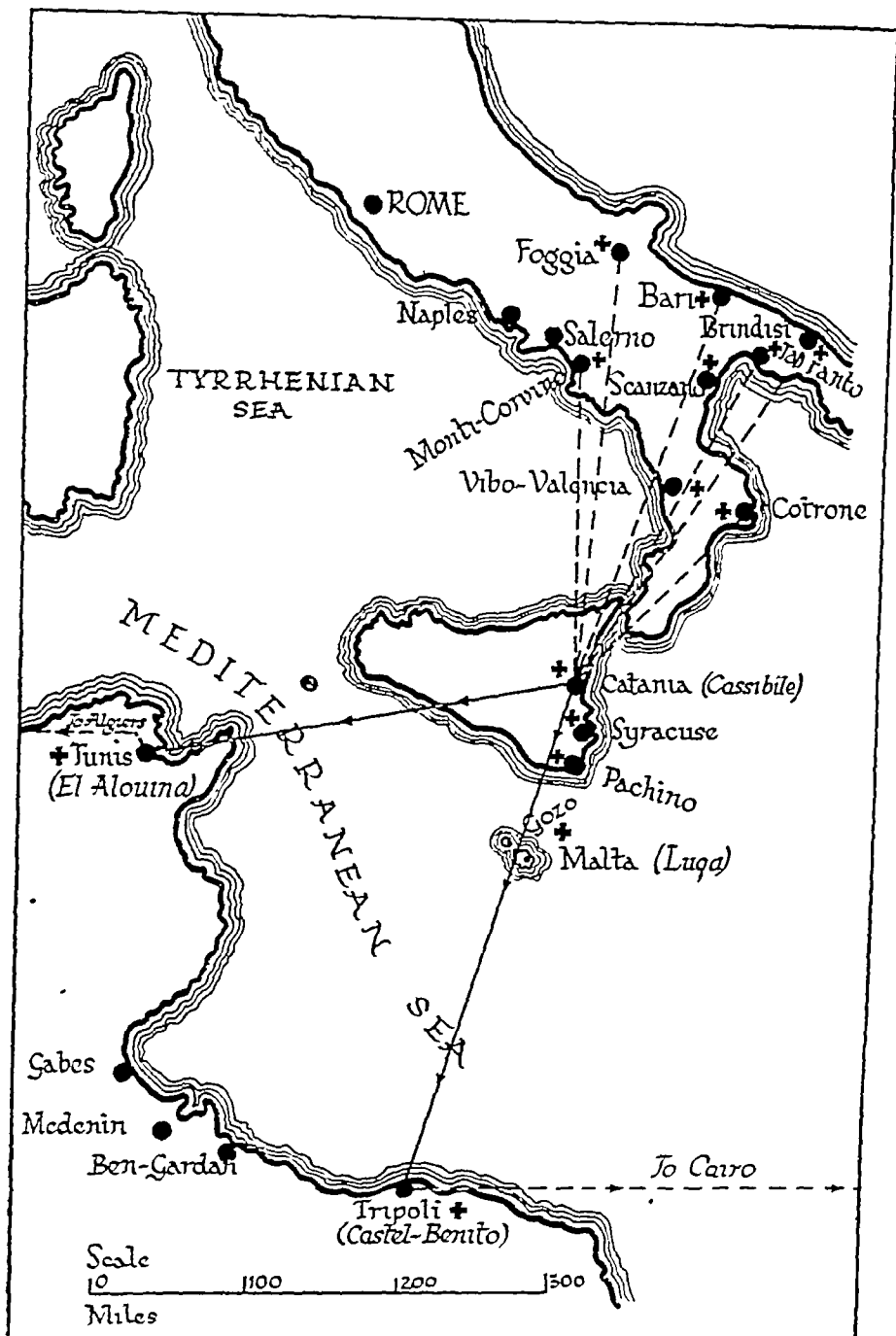
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time all the casualties had been collected from the beaches into the field ambulance and C.C.S.s in Algiers and Bougie. Accommodation had been requisitioned for the general hospitals, and they were already unloading their stores and transferring them to the sites. I made a rapid tour of inspection of the town and district, and approved the sites selected for the general hospitals, and arranged for the emptying of the brigade and Army field ambulances into the C.C.S.s and general hospitals in order that these units could accompany the brigades on their forward march to Tunisia. In the second convoy, i.e. the one from which I landed, I had some more general hospitals, and an advanced depot of medical stores. This latter unit disembarked and moved to its site and started issuing within forty-eight hours.

All units carried out a magnificent piece of work and kept at it like Trojans.

2 *The Terrain* - North Africa is very mountainous. There are three ranges running parallel with the coast. The roads are mountainous and precipitous, with numerous hairpin bends, and with the steep hillside on one side, and a sheer drop of some hundreds or thousands of feet to the sea or valleys below.

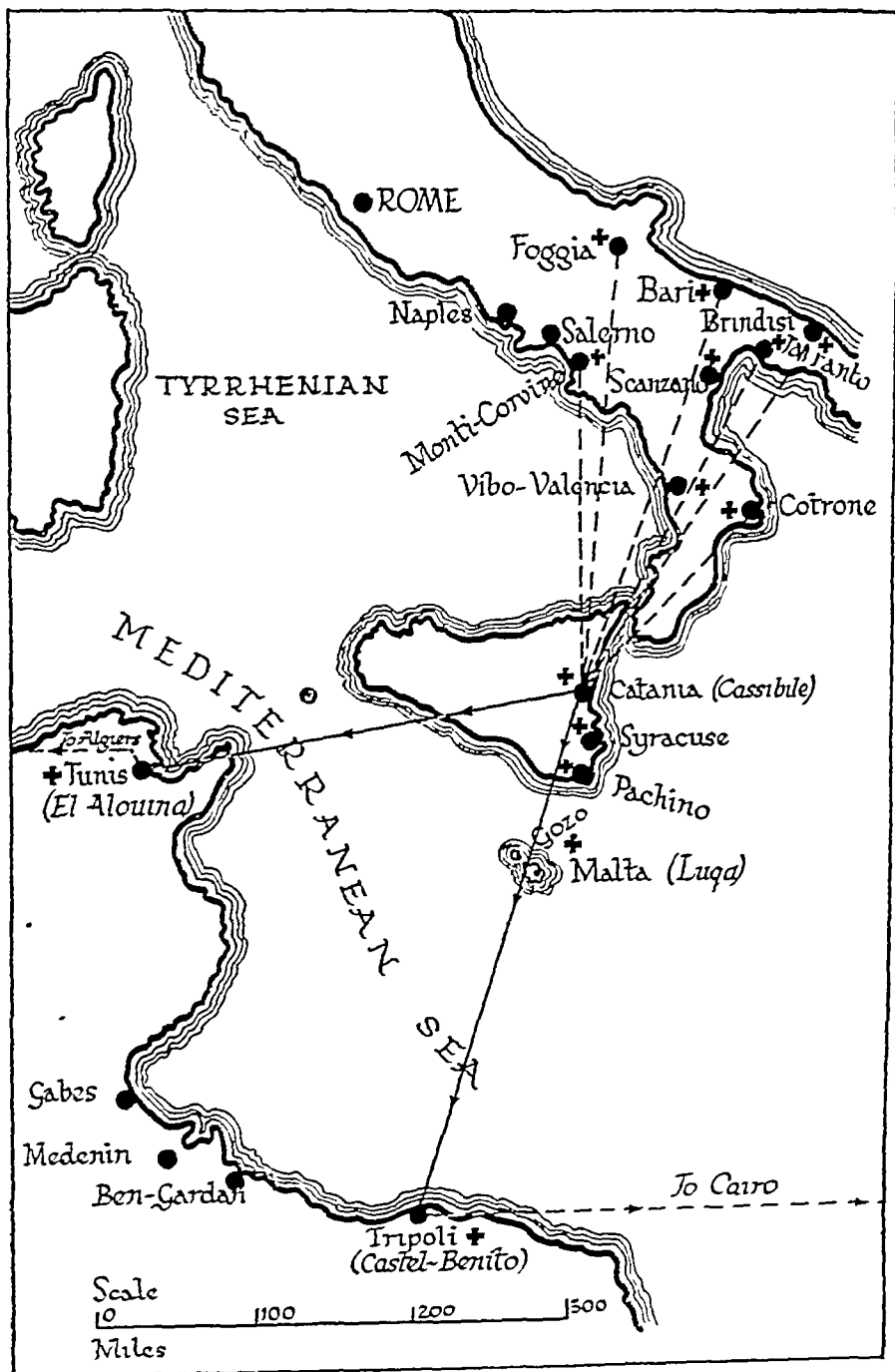
The people were on the borderline of starvation especially the Arabs, and it was several weeks before they were able to really turn out much work.

The transport consisted of a few hundred derelict old buses and lorries which had been converted to run on calor gas. Oil and grease were extremely scarce the net result being that all vehicles were badly maintained and creaked and groaned as they moved along and it was very uncertain when they started on a journey whether they would reach their destination or not. There was one single line railway the locomotives of which had been converted to burning wood as there was practically no coal in the country and the maintenance of locomotives, rolling stock and permanent ways was in a very bad way. Everything creaked and groaned as it moved along and heated axles were a common occurrence. Trains that left Algiers with a normal load practically in all cases had to be broken into two trains in order to ascend the steep gradients. There were only two roads, one along the coast, a cornice road on which there were many tunnels and the other inland running through Setif and Constantine.

The food of the country and all commodities were extremely low only the minimum had been left by the Germans everything having been sent to Germany. Livestock also was very scarce, and of poor quality.

There were very few airfields available most of our aircraft had to land on improvised dromes made on stubble fields. When the rains came, as they did very soon these airfields became converted into seas of mud on which the aircraft could neither take-off nor land so that for several weeks the enemy had air superiority and frequently

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and field ambulances, but, in order that these could be emptied of casualties and be able to accompany their fighting troops, it was necessary to include even in the first convoy an Army field ambulance, two C.C.S.s and some general hospitals.

Intensive training of the medical units that were to take part in their new reorganized assault scale formations was going on simultaneously so that, besides planning, one was heavily engaged in reorganizing and training the required units.

This training was carried out in Scotland and the normal equipment of the field ambulances, C.C.S.s, and general hospitals employed in the initial two convoys had to be worked out in detail for every article of equipment, and also standardized so that each similar type of unit landed the same articles packed in the same way and carried ashore by the personnel trained in the same way for each unit – thus ensuring that only articles of equipment that were 100% essential were landed at this stage. Special waterproof cases of such size that they could be carried ashore through sea water by two men had to be devised to contain this equipment. Another advantage of this standardization in these early convoys was that I had only to keep these units supplied with a limited number of 100% essential articles instead of the multitudinous articles authorized for land warfare with established lines of communication.

On November 8, 1942, the American force and the British launched their attack. The plan of assault was that the 11 British Infantry Brigade should land on the beaches to the west of Algiers and the American Combat Group land on the beaches to the east of Algiers. These two brigades were then to drive inland as rapidly as possible and capture the town and port of Algiers. As it turned out there was very little opposition, except to the Navy, several men-of-war being knocked about by the shore batteries. The 36 British Infantry Brigade was in ships in this first convoy ready to reinforce if necessary. If their assistance was not required they were then to proceed to Bougie and capture the town and port. As it turned out this latter task was the one they actually performed. Here again, fortunately, there was not very much opposition. I should like to emphasize that this was the first occasion on which a combined assault had ever taken place, although of course we had done numerous practice exercises on the coast of Scotland.

In order to reduce the tonnage of general hospitals and C.C.S.s beds and mattresses were left behind, and stretchers taken instead. There were no sisters in the assault convoy, their place being taken by two-thirds of their number of extra R.A.M.C. personnel.

By 9 a.m. the next morning the town and port of Algiers was captured and twenty-four hours later that of Bougie also. I landed on November 12 and was met on the quayside of Algiers by the A.D.M.S. 78 British Infantry Division and the A.D.M.S. Algiers Base. By this



and field ambulances, but, in order that these could be emptied of casualties and be able to accompany their fighting troops, it was necessary to include even in the first convoy an Army field ambulance, two C C S.s and some general hospitals

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before our departure from England for two reasons (i) the scarcity of the vaccine at that time, and (ii) again the necessity for secrecy.

From November 8 1942 to the termination of the campaign in May 1943 I think I am right in saying only 39 cases of typhus with approximately 9 deaths, occurred in 1st Army.

I was responsible for the training, planning and laying on of the whole of the medical arrangements of 1st Army, from the time planning started, until February 15 1943 when I handed over charge of the line of communication from Algiers to 1st Army H.Q. and the bases of Algiers, Bougie, and Phillipeville to the D.D.M.S., at A.F.H.Q. I was still responsible after this date for the medical arrangements of the 1st Army and the base of Bone.

One or two other items may be of interest. In January 1943 there was an American aerodrome at Biskra on the edge of the Sahara desert which was completely without medical arrangements. At this time I had a 200-bedded general hospital closed in reserve at Algiers. I arranged with the Americans that the personnel and complete stores and equipment of this unit should be flown from Algiers to Biskra. This was the first time, as far as I know that a medical unit, let alone a general hospital, had been moved by air.

Another innovation was the breaking down of 600-bedded general hospitals into self-contained blocks of 50 beds, so that these otherwise very static units became mobile, and enabled the gap between the advancing Army and the head of the line of communication to be filled.

By December 1942 the distance from Algiers to the Army was too great to be covered by motor ambulances, and so ambulance trains had to be devised on the spot from the decrepit rolling stock of the country. This entailed practically rebuilding the coaches, but the work was very rapidly carried out by the Royal Engineers.

It was a most interesting campaign and I never wish to be served by a better staff than I had at Army H.Q. nor by better medical units, and regimental medical officers than I had in the 1st Army.



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Convoys arrived at fortnightly intervals, as this was the time it took for the ships to unload and return to England. These convoys brought out reinforcements, of men, weapons and materials, but it was a slow process as the ports were very small, and the tonnage of stores that could be landed each day was very limited.

Actually the column got into Tunisia, but had to withdraw to the hills of the Tunisian Plain before the rainy season started, as the enemy was able to fly in reinforcements from Sicily and Italy on to his numerous, and properly prepared, airfields at Tunis and Bizerta, quicker than we could land our reinforcements from England.

Roughly speaking an extra division was landed each month, and by the end of March, 1st Army consisted of three British infantry and one British armoured division, comprising the 5th and 9th British Corps. There was also attached to it for a while the 2nd American Corps, though this was subsequently under the command of Allied Force H Q.

As soon as the defensive position had been taken up on the hills and fortunately before the rainy season commenced I initiated intensive instruction in anti-malarial measures. Before the malaria season started the importance of malaria as a casualty producer was thoroughly instilled into the whole force. The supply of mepacrine was short at first, but became more plentiful as the months went by. Two doses of 0.1 gm. was taken by everybody on Mondays and Thursdays of every week. The port of Bone (a base) had a total of 2,000 cases of malaria, but the number of cases in 1st Army was extremely small, showing that although 1st Army when it landed was completely ignorant of the dangers of, and preventive measures against malaria, the discipline was such that this disease was never a major factor in producing casualties in 1st Army.

Again, owing to the necessity for maintaining secrecy, it was not possible to mention malaria before embarking, although, of course, lectures were commenced on the voyage, as was the administration of mepacrine.

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Sicilian campaign after the initial landing. As executive officer of the First Medical Battalion First U.S. Infantry Division, I was more concerned with that portion of the evacuation chain which is the responsibility of the medical battalion but I shall outline first the evacuation that occurs ahead of the medical battalion.

Each regiment has attached medical personnel organized into a headquarters and headquarters section and a battalion section for each battalion. The headquarters section furnishes the overhead for administration and provides medical service for the unit headquarters and non-battalion companies (service company, headquarters company, etc.) Each battalion section provides aid men for the individual companies, an aid station group, and a litter bearer section.

The need of immediate first aid care and treatment at the scene of injury is met by the company aid men (three to a company). They follow their respective companies into combat, giving first aid as possible, tagging casualties (including the dead), directing walking wounded to the battalion aid station and placing non-ambulant sick and wounded in advantageous positions where they may be sheltered until evacuated by litter squads. The aid man follows his troops closely. Consequently there may be casualties that he cannot get to because he must keep up with the advance. These casualties are administered to, tagged and evacuated by the litter bearers from the battalion section who are in addition charged with the task of removing all non-ambulant sick and wounded injured from the fighting line and with their evacuation to the battalion aid station.

The battalion aid station should be as close to the troops served as is consistent with the combat situation. In general, the battalion aid stations were usually located somewhere in the vicinity of the rear battalion command post, which varied from 500 to 1,500 yards from the front.

The mountainous terrain of Sicily made use of the roads obligatory, and it frequently was not possible to find a suitable spot close behind troops advancing down one mountain and up another. This made for long litter hauls. To obviate this, jeeps with racks specially constructed or by simply lashing on of litters, frequently made trips well in front of the battalion aid stations. The fields were cleared, casualties collected, and the jeeps when possible, would leave roads and go cross country or if impossible, casualties were hauled by litter bearers down to the road. More and more, the ubiquitous jeep is replacing the litter bearers or at least minimizing the length of their hauls. The willingness of battalion surgeons to break away from tradition which practically though not actually forbade the use of vehicles ahead of the battalion aid station, has increased the likelihood of favorable end results for our wounded. The use of jeeps ahead of the aid stations has also permitted the location of such stations in more rearward areas with greater protection. A well trained group of 40

evacuation hospital can be located fifteen or twenty miles behind the division rear boundary and prompt and adequate medical care can still be rendered to all battle casualties, cases for immediate surgery from the division area would be routed to the field hospital platoon and the non-urgent casualties to the larger evacuation hospital further to the rear

Despite the problems that were encountered and the suggestions which have been made, the division medical service functioned in a highly efficient manner under almost all conceivable conditions of combat. Improvisations were frequently made use of and results were the important factor, not particularly the manner in which they were achieved. The division medical service should not be required to operate under any rigid 'stand operating procedure,' but rather flexibility and alterability to existing circumstances should at all times be encouraged.

APRIL 1944

## EVACUATION OF CASUALTIES IN AN INFANTRY DIVISION IN TUNISIA AND SICILY

MAJOR LEO BURGIN, M.C., U.S. ARMY

Evacuation is the most difficult task the medical corps is called upon to perform and, under combat conditions, the most important. The accumulation of casualties within any combat unit restricts its movements, and any lack of facilities and personnel to care for the wounded leads to a serious lowering of soldier morale. The true proportions of the problem are revealed by noting certain other factors operating during combat. For example, this withdrawal or evacuation must be made against a constant forward flow of troops and supplies which have first priority. Another problem is that evacuees are usually unorganized. They must be collected, transported, treated, and fed. All this, especially in forward area, must be done under difficult conditions of weather, terrain, and combat. Sick and wounded must be prepared for evacuation and care and treatment assured *en route*. The effectiveness of medical service is often a function of time rather than thoroughness and while motor transport has altered the relationship of time and space, the casualties' ability to withstand the rigors of transportation remains unchanged.

*Evacuation provided by the medical service of a division* - This service consists of two echelons, first, the attached medical personnel and, secondly, the division medical service or more specifically the medical battalion. The experiences or observations that will be presented represent those originating during the battle for Tunisia, and the

collecting company commanders parted with tradition. Advanced ambulance loading posts were set up - usually within a few hundred yards of a battalion aid station. Litter bearers or jeeps were used for the short haul from the station site to the loading post. In a number of instances, where the tactical and terrain situation permitted, ambulances drove right up to the stations. Such use of motor transport made it possible to release collecting company litter bearers for use with the battalion aid sections for clearing the forward areas, tagging wounded and assembling them for collection.

The fact that our stations were openly displayed made it possible for us to take advantage of good roads. It made it possible too for our personnel to operate more efficiently, once the fear of a directed air attack was removed. Here minor surgery of the most limited sort was accomplished. Incomplete traumatic amputations, where necessary, were completed. The greater part of the task was the giving of plasma, i.e. the treatment of shock, the stemming of hemorrhage and the control of pain. Splints were readjusted or applied, dressings tightened - or freshly applied. The patient was given food, hot drinks, etc., and was then ready for transportation by other collecting company ambulances to the clearing company. Not infrequently the medical officer might check a load of casualties in ambulances without removing the patients, and if tourniquets, dressings, etc., were in order the ambulance would be dispatched on through to clearing, administrative notes being made on the station blotter or log.

It occasionally happened, with only a limited number of ambulances available, that patients would accumulate in the collecting station. Other vehicles returning to the rear have been commandeered for temporary use as ambulances. As many as 15 litter patients may be carried in a 2½ ton truck - or 6 in a 3/4 ton weapons-carrier. These would make the run from collecting to clearing company a matter of 4 to 7 miles, not too long a run in an unsuitable vehicle.

The location of the clearing company is determined in part by the disposition of the troops. It must be located so that it is readily accessible to routes both from collecting stations and to the supporting medical unit of a higher echelon. It should be beyond the effective range of light artillery. The modern trend in warfare is to dispose artillery well forward. Consequently their effect is felt further behind the lines, therefore our clearing stations were more likely to be 7 to 10 miles behind the front, rather than 4 to 7. In one of our early engagements, at El Guettar in Tunisia, our clearing station was over 20 miles from the most forward of our troops - the division being deployed regiments in line. The tactical situation made it impossible for us to move forward to cut the distance to the most advanced of our troops. However, a good road and our ambulances more than made up for any delay and avoided the hazards of unnecessary exposure to shell fire had we tried to move forward.

litter bearers recently hauled 80 casualties over a mile course in seven and a half hours. We estimated that a jeep with racks for three casualties could have performed this task in about five hours, assuming the vehicle travelled but 10 m p h when loaded – a striking example of saving of man-power effected by motor transport. Much of our evacuation had to be done under cover of darkness, only when the front was relatively quiet could the fields be cleared during daylight hours.

Once the casualties are collected at the battalion aid station, further evacuation is the responsibility of the medical battalion. A medical battalion, infantry division, is made up of three collecting companies and one clearing company. Each collecting company is designed to furnish medical support to each of the three regimental combat teams that go to make up the standard infantry division. The clearing company supports the entire division and is organized into two platoons so that it can displace its station without discontinuing its operation.

The collecting company is made up of a station section, litter-bearer section, and an ambulance section. Its function is to collect casualties from the battalion aid stations, give further emergency treatment where necessary, and prepare the casualty for ambulance evacuation to the clearing company. These functions cannot be discharged unless some degree of protection from enemy action is afforded, this consideration points to a site well to the rear. However, the difficulties in transporting patients on litters carried by hand, and the suffering of walking wounded, point to a site near the front. Selection of the site, then, becomes a compromise between these divergent considerations. The site must be further selected so that the two or three functioning battalion aid stations may all be served. As we shall indicate, in actual combat, this problem was relatively easily solved.

The principal means of transport available to a collecting company is the large (almost 50% of the company) litter-bearer section – ten four-man squads. Two-man squads are possible but are unable to withstand the fatigue of long or frequent carries. In addition there are wheeled litters. These are a pair of collapsible wheels and frame to which a litter may be affixed. Two men are required for operation. There are two jeep ambulances and ten to twelve cross-country, 4-wheel-drive, closed ambulances.

In combat the collecting companies were commonly located 3 to 4 miles behind the front, the station openly displaying the Geneva cross – and under the circumstances rarely located near any military objectives. Litter-bearer hauls here were obviously out of the question apart from exceptional situations. The wheeled litter is heavy, awkward, and if the terrain is the least bit rough, almost unmanageable. We were left with the alternative of using our motor transport. Here again

clearing platoons, but this would obviously defeat clearing function and certainly limit its mobility. In Sicily evacuation hospitals were set up but 5 to 10 miles behind clearing. With a good road casualties were quickly got back there for treatment. In Italy at present the problem of early definitive treatment is being solved in what we feel is an ideal manner. Next door to clearing a platoon of a field hospital (extremely mobile) is set up. This is an improvement over the somewhat makeshift arrangement in Tunisia. From here casualties are transferred to an evacuation hospital.

Subsequent evacuation includes station hospitals and general hospitals and later general hospitals in the zone of the interior.

Evacuation in the division may be likened to a funnel—with the battalion aid station as the open mouth and the clearing company as the spout. The field hospital or medical unit and attached surgical teams may be considered the air vent.

APRIL 1945

## AIRBORNE MEDICAL SERVICES IN OPERATIONS IN HOLLAND

BRIGADIER A. AUSTIN EAGGER, C.B.E.

*D.D.M.S. 1 (Br) Airborne Corps*

The airborne operation in Holland in September 1944 was carried out with the object of capturing and holding crossings over the canals and rivers on the Second Army's main axis of advance from Eindhoven to Arnhem (both inclusive).

Under the orders of First Allied Airborne Army it was carried out by 1 British Airborne Corps with the following units under command: 1 (Br) Airborne Division, 82 (U.S.) Airborne Division, 101 (U.S.) Airborne Division, and 1 Polish Parachute Brigade. D-Day was September 17.

Prior to the operation, two surgical teams and a platoon of a field hospital were attached to each American division. The airborne medical organization of each U.S. division thus consisted of (a) Medical detachment with each regimental combat team. (b) One medical company. (c) One platoon of a field hospital. (d) Two surgical teams.

The medical organization for 1 (Br) Airborne Division remained unchanged, namely (a) Medical detachment with battalions. (b) Two Parachute field ambulances, each with two surgical teams. (c) One air landing field ambulance with two surgical teams. That of the Polish brigade was similar, namely a Polish parachute field ambulance with two surgical teams.



The main function of clearing is the process of disposing of the casualties of a division. It consists of sorting all casualties of the unit, returning to duty such as are immediately fit for full duty, and transferring all others (except the dead) to a medical unit of a higher echelon. Hospitalization does not properly belong to a clearing company. As casualties come through battalion aid stations collecting stations, those readily treated and obviously fit for duty again are sent back. At clearing, more time is available to evaluate questionable cases. More time, in fact, has elapsed since the injury took place and so the effects are more readily noted by the time a patient reaches the clearing station. The clearing station must be kept mobile. While it is organized into two platoons, making it possible to displace itself without the cessation of function, the rearward platoon must itself close up and be prepared to leap-frog the forward one in a matter of hours. There have been occasions when both platoons have been committed as when a wide flanking movement of one combat team was contemplated or when our front was so broad that it was more efficient to employ two stations. It is obvious that definitive treatment cannot be a part of clearing company function if it is to be kept mobile. Extremely urgent cases have been operated upon, but control of hemorrhage and treatment of shock are the main medical tasks here. When we were more or less certain that a move was unlikely we have kept casualties for twenty-four hours, such as mild respiratory cases, early, so-called exhaustion cases, dental cases, etc. In the case of officers, we frequently kept some more than twenty-four hours, in this way they would not be lost to the division by evacuation outside division control. The few so handled were easily carried with us as we moved. In Sicily, our clearing station moved 14 times in twenty-eight days of fighting.

A surprising thing was that of some 6,000 casualties evacuated through our clearing station in Tunisia and Sicily, only two deaths occurred in the station. Those casualties surviving the initial trauma were back to clearing in sufficient time to receive shock therapy and hemostasis to maintain life until they reached a higher echelon providing definitive treatment.

The responsibility of the division for evacuation terminates when casualties reach the division clearing station. Further evacuation is a responsibility of a higher echelon, usually army, but in Tunisia and Sicily it was corps, acting practically as an army.

*Subsequent evacuation* - In Tunisia, to obtain early definitive treatment, a clearing platoon from other than a divisional unit, with attached surgical teams, operated a matter of 100 yards from our own clearing platoon. Abdominal wounds, sucking chest wounds, and the most acute cases were treated here; the others were evacuated to a surgical hospital some 15 miles behind, and thence to an evacuation hospital. It was suggested that surgical teams be attached to our own

buildings earmarked as hospital accommodation. Berchmanum College, which was in the process of being converted by the Germans into a Hitler Mother obstetrical unit was taken over at once. The US clearing station was instructed to move there on D+3 and remained there throughout the operation.

Berchmanum College had accommodation for 450 cases but at one time was holding over 800. Accommodation for a C.C.S. was taken over at Jonkers Bosch. No 3 C.C.S. was opened up on this site on September 22.

No evacuation of casualties from the clearing station at Berchmanum College was possible until September 21 (D+4) when 200 casualties were evacuated. This was repeated the following day but owing to the main axis being cut, evacuation was interrupted from September 23 to 27. After that it proceeded without difficulty.

This clearing station admitted a total of 2 974 cases.

Signal communication with 1 (Br) Airborne Division was, from the commencement of the operation, intermittent and unreliable and it was not until September 22 that the first signal was received from A.D.M.S. 1 (Br) Airborne Division. This stated that the division had 2 000 casualties and was urgently in need of medical supplies. Arrangements were made to drop an additional 2½ tons of medical stores to meet this requirement.

163 Field Ambulance was placed under Command of D.D.M.S. 1 (Br) Airborne Corps and was moved on to the island with instructions to establish a casualty evacuation point on the north bank of the Neder Rhin if the attack of the 43 Division in the night of D+7 was successful. With the object of getting medical stores to the 1 (Br) Airborne Division, on the afternoon of D+7 Lt-Col Herford O.C. 163 Field Ambulance and Captain Louis, O 1/m/c H.Q. 1 (Br) Airborne Corps, crossed to the German lines on the north bank of the Neder Rhin in a boat loaded with medical stores. They were not fired on. Col. Herford left the party on landing, eventually made contact with 1 Airborne Division, stayed with the medical services for three weeks and eventually made his way back to the British lines. Captain Louis and the other ranks were captured, but given a safe conduct back to our lines with the stores. Captain Louis and Lieut. (Q.M.) Tiernan accompanied a battalion of the Dorsets when they attacked that night in yet another attempt to get medical supplies to 1 Division. The Dorsets were overwhelmed. Tiernan swam back. Captain Louis is presumed to have been killed.

On September 21 (D+4) two-thirds of the Polish Brigade dropped in the Driel area with the intention of crossing the river to reinforce 1 Division. By September 22 a dressing station had been established in the school at Driel. This station was repeatedly hit by mortar and artillery fire but admitted 159 casualties of which 62

*General medical plan* - The general medical plan was that casualties were to be held and treated in divisional areas until contact was established with medical units of the supporting ground force. The arrangements for the maintenance of medical units were -

(1) All medical units to take in the initial lift sufficient medical stores to deal with the estimated number of casualties for a minimum of forty-eight hours

(2) Medical supplies to be prepacked for daily maintenance by an (parachute drop) for five days

(3) Detachment of an advanced depot of medical stores, consisting of 8 Dakota aircraft loaded with medical stores to be flown in with the airborne forward delivery airfield group (This was originally intended to be flown in to Deelen airfield (north of Arnhem) In actual fact it was flown in to Ood Keent Airfield south of Grave on D+9, i.e. September 26)

(4) All British gliders to carry 2 airborne stretchers and blankets

Additional medical supplies were available at base supply aerodromes on demand

*Operational narrative* - 101 U.S. Airborne Division landed north of Eindhoven in the Zon Area on D-day and D+1 and gained all their objectives

On D+1, 326 Med Coy of 101 Division had established a clearing station at Zon with one surgical team, and the platoon of the field hospital had opened up at Vechel with the second surgical team. Evacuation of casualties to 24 U.S. Evacuation Hospital commenced D+2 and continued without any difficulty

The medical units of this division admitted a total of 2,990 cases.

82 U.S. Airborne Division and H.Q. British Airborne Corps landed between Grave and Nijmegen on D-day. The division seized intact the bridges over the Maas at Grave, and also the bridges over the Maas-Waal Canal, but met with considerable opposition in Nijmegen and did not capture the Nijmegen Bridge until D+3

On D+1 a clearing station formed by 307 Med Coy and the attached platoon of 50 (U.S.) Hospital was established in a field 2 miles west of Groesbeek and all divisional casualties were cleared to this clearing station

On D+2 D.D.M.S. 1 (Bt) Airborne Corps went to the only civil hospital which was still functioning in Nijmegen, the St. Canisius Hospital. The director and medical staff were most co-operative, and agreed to take in 50 of the most serious casualties from 82 Division at once

A reconnaissance of the area was then carried out and suitable

which was shown by all ranks in this operation. These officers and men were the pioneers of the British airborne medical services and had served in North Africa Sicily and Italy. They remained with the casualties after the division was withdrawn and in the various prisoner of war camps under the most difficult conditions, continued to care for those under their charge with skill and outstanding courage.

APRIL 1945

## THE R A M C AT ARNHEM

COLONEL G. M. WARRACK, D.S.O., O.B.E.

*1 D M S 1 Airborne Division*

The medical services of the 1 Airborne Division which took part in the battle at Arnhem in September 1944 consisted of three field ambulances the 16 Parachute Field Ambulance, the 133 Parachute Field Ambulance and the 181 Air Landing Field Ambulance. In addition there were regimental medical officers and about a dozen R.A.M.C. orderlies with each fighting unit. The Polish Parachute Brigade and its field ambulance were also under command.

To understand the situation the general plan of battle must be considered briefly. The division was to drop in three lifts on three consecutive days.

*Phase 1* - The landing on the first day was to consist of the 1 Parachute Brigade, the 1 Air Landing Brigade and part of divisional troops including the 16 Parachute Field Ambulance, and 181 Air Landing Ambulance. The task of this force was in the first place to capture the main road bridge over the Rhine, and in the second place for the air landing element to secure the dropping zones for the second lift on the following day.

*Phase 2* - The 4 Parachute Brigade and the remainder of the divisional troops (including 133 Parachute Field Ambulance) were to land on the second day and move forward into the town with the covering party who had been protecting the dropping zones and consolidate a bridgehead there.

*Phase 3* - This was to consist of the Polish Parachute Brigade. They were to drop on the third day south of the Rhine and take over an area to the east of Arnhem.

*Original medical plan* - Dropping zones and landing zones were to be cleared of casualties by units. A temporary dressing station was to be established in the neighbourhood of the landing zones and dropping zones by 181 Airlanding Ambulance. The 16 Parachute Field Ambulance was to go into Arnhem with the 1 Parachute Brigade

were operated on by the surgical teams. Evacuation of casualties to 3 C C S at Nijmegen commenced on September 24

*Surgical teams* – The large number of serious casualties which occurred threw a very heavy strain on the surgical teams. In the case of the U S divisions they worked under good conditions with suitable accommodation. The surgical teams with the 82 Division between September 18 and 30 carried out 523 operations of which 284 were major operations, and included 64 abdominals and 34 chests

In this series blood was given in 67 cases, lightly wounded being used as donors in the majority of cases. Large quantities of oxygen were used, but the supply was inadequate for three days. The use of oxygen was undoubtedly a life-saving factor in the post-operative care of these chest injuries, but the carriage of an adequate supply in airborne operations presents an extremely difficult problem

#### SUMMARY

The American-British medical organization proved to be sound and capable of dealing efficiently with a large number of casualties

In the British organization each brigade is supplied with a self-contained medical service to include surgical teams. The U S organization, on the other hand, is on a central divisional basis

The great value of surgical teams with airborne divisions was again evident in this operation, and undoubtedly the work carried out by these teams was the means of saving many lives

The glider element with each parachute medical unit enabled transport and medical stores to be brought in, but it is considered essential that a complete medical service, including surgical facilities, should be available on a purely parachute basis

This operation confirmed our previous experience that re-supply by air is both unreliable and uneconomical. The only alternative appears to be to take in as large a supply as possible by glider in the initial lift. This quantity, however, is limited by the fact that unless the landing zone remains within the perimeter of defence, it is useless to bring in more supplies than can be moved in the transport available

One of the most outstanding characteristics of this operation was the loyal co-operation which existed between the medical services of the various airborne formations involved. The team spirit was highly developed with a determination to overcome all difficulties, and to ensure that everything that medical skill and intelligent forethought could provide was made available for casualties

The standard which the medical services of 1 Airborne Division had attained in previous operations was a high one, but that standard was eclipsed by the self sacrifice, gallantry and devotion to duty

by shell and mortar fire and one was burnt to the ground two were rendered uninhabitable. Often one or more buildings were captured by the Germans, but they saw how acute the medical emergency was and allowed the staff to remain. I cannot speak too highly of the extreme bravery and self-control shown by the wounded under these most appalling conditions even when mortaring was at its height, when glass and plaster were falling in profusion and when bombshell fragments were whistling through the windows, there was never a murmur or sign of hysteria from the wounded. It is one of the most shattering experiences to see men who have been wounded in battle being killed and rewounded in bed where they should be safe. It is felt, however, that the damage caused to the hospital buildings was not wilful as the whole area was extremely small and the medical buildings were on the edge of the perimeter.

*Evacuation* of casualties from regimental aid posts to dressing stations was a hazardous business, and was done by jeep and by hand carriage. We used to teach soldiers to drive jeeps slowly when carrying wounded to avoid undue shock but in the circumstances it was considered safer to arrive with a shocked patient from fast driving than not to arrive at all, which was the other alternative. By the fifth day it was no longer possible to carry out any proper surgery. The rooms where the surgeons were working in the annexe had been wrecked and the cellars were completely inadequate for surgery. By the seventh day of the battle it became extremely perilous to admit any more to the already overcrowded dressing station buildings and it was decided that the wounded must take their chance in the more dispersed regimental aid posts. Finally on the Sunday, a week after we landed the A.D.M.S. visited the G.O.C. as usual at his headquarters and explained how very bad the medical situation was. It was agreed that he should approach the Germans who by now were occupying the dressing station and ask that they should evacuate our seriously wounded to their own safe hospitals. The G.O.C. was emphatic that this must not seem a sign that the division was weakening but merely that the battlefield should be cleared to enable the fight to continue. The A.D.M.S. collected an interpreter a fellow from the Dutch Resistance who had dropped with the Division and made his way back to the dressing station. They were taken to the German Divisional Headquarters where they met the opposing General and stated their case. General Blaskowitz agreed to (a) evacuate all our wounded and (b) to stop firing on the dressing station area and on the regimental aid posts. Finally the A.D.M.S. was given a bottle of brandy by the German H.Q. staff and went back into the perimeter (The Germans rightly called it 'The Cauldron').

*Case of interest* - One of the wounded evacuated by the Germans was the commander of the 4 Parachute Brigade. He had been wounded in the belly by a fragment of mortar bomb. He was admitted

and set up in St Elizabeth Hospital After the arrival of the second lift 181 Airlanding Field Ambulance was to move into the town with 133 Parachute Field Ambulance, each unit was to set up in its own brigade area Regimental medical officers and their staffs were to remain with their battalions all through the battle and to evacuate casualties to the nearest dressing station So much for the original plan and the medical arrangements

*Diary of the battle* - What actually happened is well known The first lift landed safely with very few casualties The 1 Brigade formed up quickly and moved off towards the town with the 16 Parachute Field Ambulance in attendance Part of the brigade reached the bridge and stayed on the north end of it for four days in the face of overwhelming odds; finally they were all killed, wounded, captured or dispersed The 16 Field Ambulance got to St Elizabeth's Hospital at 22 00 hours on the first day and found casualties already awaiting them on the steps of the hospital They took over part of this hospital and the surgeons were operating within ten hours of landing 181 Airlanding Field Ambulance established its dressing station in the area of the dropping zones and admitted over 150 wounded within twenty-four hours The second lift was six hours late and the Germans contested their drop strongly More casualties were admitted to the 181 Field Ambulance, bringing their total up to 250 On the evening of the second day the remainder of the division moved in towards Arnhem, and by nightfall they were concentrated at Oosterbeek and it was here that they were contained by a large enemy force complete with tanks and self-propelled guns The 4 Parachute Brigade as already mentioned had a very rough passage on its drop and a hard time trying to rejoin the rest of the division By the evening of the third day the battle was in two clear parts, (a) the 1 Parachute Brigade were at the bridge fighting stubbornly (its Field Ambulance (16 Parachute) had been captured by the Germans on the second day and moved out of the hospital, and the two surgical teams were allowed to stay and deal with over 100 wounded) and (b) the airlanding Brigade and 4 Parachute Brigade were in the divisional perimeter at Oosterbeek with the 181 Airlanding Field Ambulance and five officers and thirty other ranks of 133 Parachute Field Ambulance in support

*Conditions in the perimeter* - The Divisional area was about half a mile across and about one mile in length stretching north from the river. In this area there was a medical area occupied by 181 Field Ambulance, the remnant of 133 Field Parachute Ambulance (now reduced to 5 officers and 5 other ranks, the remainder had been captured by the Germans during an attack) and 4 regimental aid posts The original dressing station started off in a large hotel with a surgical annexe in a near-by emergency hospital of 30 beds It gradually spread, as wounded poured in, to over 10 buildings They were consistently hit

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Protecting Power was or how to make contact with it. The threat sufficed however and next time 500 wounded were moved to Germany in a fully-equipped hospital train. During our stay at Apeldoorn we were visited by the Director of Medical Services of the German Armies on the Western Front. He seemed pleased with what he saw. Finally after a number of medical officers and others had escaped the hospital was closed and the staff dispersed to German hospitals in Holland and Germany.

#### CONCLUSION

This has been a very short and sketchy account of the doings of the R.A.M.C. at Arnhem. There is no doubt, however that many gallant soldiers of our division owe their lives and their limbs to the care of these doctors and orderlies who carried on their work under such extreme difficulties. Last but by no means least, we shall never forget the help we received from the brave Dutch

to the St Elizabeth Hospital where the parachute surgeons were still working. They opened him up and found he had fourteen holes in his small intestine. These were sewn up, the wound was closed and a drain left *in situ*. He was given transfusions and put back to bed, careful instructions were given to the nursing orderlies of the R A M.C. who were to tend him. Ten days later a member of the Dutch Underground visited the hospital, then completely taken over by the Boche, and asked the British surgeon if he had any cases fit to travel and live underground. The brigadier was selected as being the most important soldier there (he was always referred to as 'Corporal' in the Hospital). He was not very keen to get up at first but made a big effort. He was dressed in civilian clothes and a bloody bandage was wound round his head, he walked out of the hospital on the arm of his Dutch friend who drove him away under the eyes of the Germans to a safe place. He got back into our own lines over four months later after a long and perilous journey. This I think is a great tribute to his personal courage, to the efforts of the surgeon who operated, to the staff who nursed him and to members of the Underground Movement who sheltered him.

*Withdrawal* - On the following day G O C informed the A D M S that the division was pulling out that night on orders from Montgomery. It was explained that we had over 2,000 wounded, and that it would be better for the medical services to stay behind to look after them. The A D M S was to procrastinate as much as possible in the hope that the relieving force of the 2nd Army would be up before the wounded and staff were moved back into the heart of the Reich. The first stage was a move of wounded and staff to a bare barracks at Apeldoorn. There 1,400 wounded were admitted and many more to the neighbouring hospitals. They were surrounded by barbed wire and guarded by elderly members of the *Wehrmacht* known as 'Bismarck Youth' (There were over 4,000 German wounded in the area, mostly from the Arnhem battle). In these barracks we established the 'First Airborne Divisional Military Hospital in occupied Europe'. The staff consisted of 24 officers and about 200 orderlies of the divisional medical service. The accommodation stores came from Dutch sources, as did food and large supplies of medical stores. The Germans gave what help they could with the limited stores they had available. Their chief doctor viewed with joy the proposition that the British would fly in medical supplies for our wounded if it were allowed. When he put this plan to Field Marshal Model it was turned down. We sat there waiting as the weeks slipped by and the hoped-for attack did not come through. Gradually and under protest our wounded were moved to Germany, at first in cattle trucks with straw, little food and no sanitary arrangements and the wounded were wired in. After this strong protests were made to the commandant and he was threatened with an official protest to the Protecting Power. At the time no one was quite sure who the

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## EXPERIENCES OF A DUNKIRK PRISONER OF WAR

LIEUTENANT-COLONEL P. H. NEWMAN D.B.C., M.C., R.A.M.C.

*Surgical Specialist, R.A.M.C.*

I have recently returned from a German prisoner-of-war camp and I want to convey to you a rough impression of what life is like for those who have been unfortunate enough to be caught up in the Nazi web.

After Dunkirk those who were fit to walk, and some who were not, were taken by forced marches across Belgium to the Rhine in Holland. The marches consisted of some 25 or 30 miles a day with nothing but a few ounces of bread and a cup of ersatz coffee as rations. At night they were mustered together in a field or barn with just the kit in which they stood. Stragglers who fell by the wayside were beaten up or shot. At the Rhine they were herded into barges, about 2,000 to each barge, without sanitary arrangements or room to move up on deck for fresh air.

The wounded were gradually gathered up and put into various hospitals or buildings that were called hospitals. The 450 gravely wounded, who were too ill to be moved on to the boats during the evacuation, were taken to bombed-out sheds. Here nothing more than a small box of bandages and three phials of morphia was available on arrival. Their rations consisted of black beans, bread and a watery vegetable soup. They lay pale and listless on the same stretchers on which they had first been placed and their wounds showed no signs of healing. In the early days of captivity many of them died, but those who survived the first weeks became hardened to it and gradually, as the conditions improved, they began to have an interest in recovering, crawled out of their beds and started to walk about the camp.

N.B. - I should like to pay a tribute to all those grand people of France, Belgium and Holland who did so much to smuggle in extra food to the wounded. One woman I remember was about to enter a hospital with a large parcel under her arm when she was stopped with the point of a bayonet and told that entry was verboten. She lifted the bayonet with her hand, kissed the sentry and walked in. The more the guards were determined to keep the extra food away the greater was the quantity which arrived.

Those early days were the worst for everybody. It could be summed up as the 'breaking in' period. Most of our fit men were taken to Poland and there some of them lived in an open field without shelter during the Autumn of 1940. Some of these men I met. They had become quite animal-like in their mode of life. Their pride had gone





## ARCTIC CONVOY

SURGEON LIEUTENANT W D G. TROUP R.N.V.R.

On being told of our forthcoming trip to Russia we were at first filled with apprehension Russian convoys at that time being most hazardous undertakings. However, as the time of our sailing approached we began to look forward to it, as one generally does when on the threshold of an adventure. The great day of sailing eventually arrived and several days later we reached Iceland. The fiord in which we lay at anchor reminded me very much of Scotland - the air had a bite, and tall mountains rose sheer out of the water on either side. There were assembled H M ships of every description cruisers destroyers of every class rescue ships corvettes and trawlers. Our stay there was a brief thirty-six hours. Soon after leaving we met up with our convoy - a most impressive array predominantly American liberty ships, but with the United Kingdom, Holland and Norway well represented. Those who have not sailed with a big convoy cannot visualize the majestic appearance of large merchant ships sailing along in several columns in perfect formation.

For the first three days nothing much happened. We were told that U boats were trailing us, but as these kept a respectable distance from the convoy and showed no sign of fight, we did not take a 'dim view' of them! Our sense of security was soon shattered, however for on the fourth day a Blom-Voss reconnaissance plane made its appearance, very annoyingly circling round the convoy well out of gunfire range, after several circuits he made for home. Approximately two hours later the fun began. The alarm bell sounded and off we went to our action stations. Mine was the sick bay in the afterpart of the ship on the lower deck. I cannot say I relished such a position, as one never knew what was happening. The sick berth petty officer took up his position in the wardroom forward which we had as an auxiliary sick bay. Soon fifty torpedo bombers (special Hermann Goering squadrons based on the Norwegian coast less than two hundred miles away) came in to the attack. An enormous A.A. barrage was put up by the escort (this convoy sailed before the days of small aircraft carriers), but despite this in they came. Three merchant ships were sunk, most of their survivors being picked up. Worst of all an ammunition ship was hit, the whole just disintegrating into nothingness. After three to four hours the attack ceased and the convoy kept on sailing. All was peaceful until nightfall when the attacks began again, carrying off four more ships. One began to long for a good old English blackout for all there was of night was about an hour of semi-dusk.

The following morning found us somewhat jaded after a night at

and they appeared to have no interest in anything but themselves.

Gradually the camps became available and conditions improved. The men learnt to adapt themselves to this meagre existence and to live in the future rather than the present. Broadly speaking prisoners were divided into two groups.

Those below the rank of sergeant had to work. Typically they were split up into small groups living in villages. They were forced to work twelve hours a day and if they refused they got no food. They were put under the charge of a German corporal and two men and never saw any higher ranking official with whom to lodge their complaints.

Those of the rank of sergeant and over were not expected to work. They were housed in large camps with nothing to do except attend numerous and lengthy parades for roll-call and kill their own boredom as best they could.

About six months after capture the Red Cross parcels began to arrive. This had a tremendous effect upon the general morale. Some of the lost weight was regained, initiative and a will to plan and organize life returned. Lectures, concerts, sports clubs and various societies were started, and a mere existence was turned into something that might be described as 'Life in a Nutshell'. Moreover, the parcels consisted of very valuable material in a land where money was valueless. They gave bargaining and bribing power over the German guards. There is no doubt that these parcels saved many lives, healed many wounds, prevented much illness and cheered up thousands.

The experiences of a prisoner of war can broadly be divided into four stages -

- (1) The breaking-in period
- (2) The convalescent period
- (3) The long period of boredom
- (4) The repatriation period

It is the last of these that may well prove to be the most difficult.

It is to this time that all his interests and hopes are attached and it will be liable perhaps, after years of yearning, to be coloured a little too brilliantly and to be idealized beyond its capacity. The repatriate will arrive home after experiences quite different from those around him. He will appear perhaps a little abrupt and unruly in his determination to catch up with what he has lost. He will have an apathy and a sluggishness of camp life to throw off, a shyness in mixed society to conquer, and a topical conversation to remuster. He will tend to be restless, undisciplined and short-tempered, but these are merely release phenomena and will, I believe, pass off in a few months. The morale of the men in the different camps that I saw was excellent and there is not one of them who doubts the eventual outcome of this war. Their spirit is grand and will last till the end.

as my sick bay which could only hold four cot cases, was now full to overflowing

I have only room for a brief summary of the interesting two and a half months I spent in Archangel. Three naval doctors including myself arrived with the convoy and we spent a considerable amount of time visiting the Russian hospitals where over a thousand British and American casualties were accommodated. We were able in some small way to act as a liaison between them and the Russian doctors. The hospital staffs, both doctors and nurses, were most courteous and kind but were working under great difficulties. Essential drugs, particularly anaesthetics, were in short supply the sulphonamide preparations were unknown. Anaesthesia was not used for dentistry which greatly reduced the demands for dental appointments! I was kept quite busy in the mornings looking after the crews of twelve merchant ships (mostly American). In fact our captain suggested that I put my brass plate on the gangway!

As our ship was only victualled for a month (its maximum capacity) and was away from the United Kingdom for over three, our food situation became rather precarious. Potatoes ran clean out and were replaced by rice, much to everyone's disgust. Bread was rationed to two slices per day: no fresh vegetables were obtainable and the only meat was tinned. As regards entertainment ashore, there was a weekly film (American or British) in the International Club and an occasional football match, our team being most embarrassed on being presented with a bouquet of flowers by the opposing Russian team! It certainly was a great tribute to the very good discipline and good heartedness of the British sailor that living under most trying conditions, there was neither a single word of serious grumbling nor any disorderly conduct whatsoever during our two and a half months' stay.

At last we sailed for home, all of us I think being ready for the sight of old 'Blighty' again. The voyage back was quite different from what was expected. There were no air attacks but instead there were incessant U boat attacks day after day. Four merchant ships were sunk and the one little rescue ship which survived the outward trip did magnificent work looking after nearly 300 survivors. We arrived back with only eight out of 37 merchant ships left, but with the satisfaction of knowing that at least some vital supplies had reached the U.S.S.R. and that we had weathered the worst Russian convoy of the war.

action stations, and we were certainly grateful for a peaceful morning and afternoon. Just after tea I was in the process of extracting a tooth from some luckless steward when the news came through that the *Tirpitz* had escaped from a Norwegian fiord. On deck one could sense the excitement in the air as small groups of sailors stood around speculating as to our fate! Our instructions from the Admiralty in the face of this startling event were to scatter, and our ship in company with a corvette steamed 'hell for leather' due north. Ships were steaming in all directions and many an unfortunate merchant ship was bombed and sent to the bottom.

As evening wore on a friendly fog came down, but there were frequent grating noises as the ship ploughed through iceflows and with every few hundred yards the ice seemed to grow thicker. The weather turned bitterly cold and small icicles formed on the rigging – in fact we all felt we had been in happier surroundings than these. The following day we anchored in a narrow inlet, staying there for twenty-four hours to collect our scattered wits and to plan ahead. Two Liberty ships joined us and off we set for the White Sea. We had not long been on our journey before we had another aerial attack and I had my first action casualty. He was a Newfoundlander doing look-out duty in the crow's nest, the side of which had been blown in by crossfire from one of the Liberty ships. By the time I had reached the foot of the mast from the sick bay, my sick berth petty officer was already trying to extricate him. This was no easy feat as he was jammed in the nets because of his voluminous arctic clothing. He was eventually lowered by a line and pulley, a very creditable performance at any time, but especially so when undertaken in the middle of action with a fair gale blowing. Having cut his clothes off in the sick bay I was horrified to find a ragged cavity in his left buttock approximately the size of half a football. As he was badly shocked he received the usual morphia and a plasma saline drip was set up. An attempt was then made to remove all the shrapnel from the wound – a shovel would have been the best instrument, such was the quantity! After as much as possible had been removed the wound was packed with gauze and sulphanilamide powder. He nearly died of shock during the night, but further administration of morphia and plasma saline I think saved him, or may be it was his hardy Newfoundland stock.

The next afternoon we picked up some American and British merchant seamen who had been adrift in an open boat for four days amongst icefloes. Nearly all had immersion foot in various stages, varying from intense neuritic pain with no signs, to small plum-coloured areas of gangrene.

We were all much relieved when we entered the mouth of the Dvina river and berthed at Archangel. I was particularly glad to learn that my casualties could be accommodated in Russian hospitals,

and engaging in sabotage. They were supplied by the people on whose territory they happened to be at the moment. Those under 20 and over 40 were used as couriers and for the supply and medical services.

The High Command had a doctor as commander-in-chief of the medical service. Every corps had one doctor as chief medical officer (sometimes he was a student of medicine). His duty was more to organize than to treat the patients and wounded. One chemist was usually attached to each corps. All doctors and all hospitals in the territory of a corps were under its command. Every brigade had at least one nurse, as had a battalion. Village units had one or more peasant women in charge to nurse the soldiers.

Attached to the High Command was a school for nurses, who had a special uniform. Over 1 000 passed through this school. The chief nurse was the closest collaborator of the chief medical officer of the High Command. Gradually the Army collected educated nurses everywhere. In the beginning the wounded or ill soldiers were nursed in villages in the houses of the peasants, by the peasant women, or in the village health co-operatives (there were about 100 health co-operatives before the war) whose personnel was gradually increased. There were mobile forest hospitals which served the fighting brigades. Usually a fighting brigade had about 20 stretchers, and about 40 to 50 stretcher bearers. One village or more had to supply a peasant cart for every sick or wounded soldier so the commander of a village had to mobilize the necessary number of carts. If there was a move, the carts were used only as far as the next village. In that way the peasants did not wander far and new horses and oxen moved the wounded farther on - at once if necessary. An operational field theatre was always prepared and the doctors were called when required.

Later on, when the organization penetrated into the towns the sick were sent to the hospitals. Some wounded soldiers were also treated in hospitals if these were not German controlled or if the wounds were old ones.

Thus, there were two kinds of patients, one so-called 'legal' under German control, the second illegal. The first could go and be found by the Germans, and without fear explain he was a sick peasant because he would be carrying a forged identity card. The second one was known by the enemy and had to be treated in a village, forest hospital, or health co-operative. In that case the doctor had to come to see the patient, and treat him as long as was necessary or even to operate in camp hospitals, which were sometimes very well equipped. Thus there were two kinds of doctors - legal and illegal. The legal doctor registered by the Germans, who refused to help was considered a traitor, but this was very rare.

Many soldiers were treated even in Belgrade hospitals without being discovered by the Germans.

## YUGOSLAVIA UNDER ENEMY OCCUPATION

MILOSH SEKULICH, M.D.

*Medical Adviser to Yugoslav Ministry of Health and War Ministry*

On March 25, 1941, the Yugoslav government signed the Tripartite Pact with Germany. The people opposed it, and on March 27 they overthrew the government without the spilling of one drop of blood. This meant in fact, the declaration of war on Germany. Hitler ordered the attack on Yugoslavia on April 6. The Yugoslav Army was only partially mobilized, and was not prepared. In about two weeks the army was destroyed, and the country was occupied by Germans, Italians, Bulgarians, and Hungarians. A new puppet State was formed—the independent state of Croatia—from one part of Yugoslavia.

But the people did not give way. Small units dispersed everywhere and refused to surrender, remaining in the mountains, villages, and forests. In fact, the enemy occupied the towns and lines of communication, while the country remained free. The people grieved over the short and unsuccessful fight, and wanted to fight back quickly, thus continuing the March uprising or revolution. The Army was reorganized for guerilla warfare, with a High Command in Central Serbia on Ravna Gora (Suvobor mountain). While dispersed units fought a defensive and non-organized warfare, the High Command started gradually to organize the country. They linked up all armed units, and tried to create everywhere a new type of military organization. Naturally the organization quickly took root in the villages. Every village had chosen (in a purely democratic way) the civil representative of the place, and the High Command sent, or appointed from the village, an officer or a non-commissioned officer, or sometimes a private, as a military commander. The former had to supply the Army with the men, food and materials, as well as to organize the courier service, and sanitary service. Every village supplied one unit for the territorial army. A few villages formed a battalion, and the territory of a district formed a brigade. Two or three brigades formed a corps. Every corps had as its commander a captain, major, or lieutenant-colonel of the active or reserve army service. The corps commander was responsible for his territory, and seldom moved away from it, defending the people, and preventing the enemy from collecting food or any kind of raw material necessary for his war effort. The territorial army was formed of men between 30 and 40 years old. The fighting brigades, which were formed separately of men between 20 and 30, were not linked to their territory; they were offensive units, and constantly changed their rendezvous for attacking the enemy, collecting weapons.

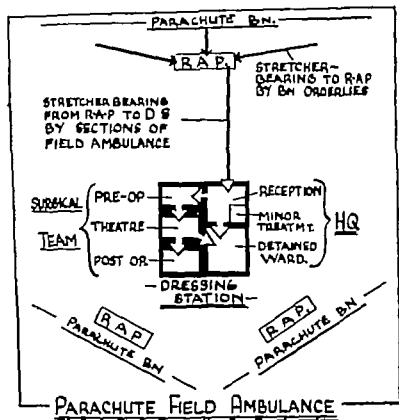


FIG. 1

Medical Organization and Technique in Airborne Operations

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from *Brit. J. Surg.* 32 (1944-45), p. 276

specially designed stretchers, and blankets. Most of it is landed by parachute containers released from bomb racks as the men themselves jump. A scheme of the brigade medical organization in being is given in fig. 1.

The present operation aimed at the capture and subsequent defence of the Primasole bridge, carrying the eastern coast road across the most formidable water barrier on the axis of our advance in Sicily. This operation was to be carried out well behind the enemy lines to facilitate the advance of our ground troops. Reference to fig. 2 will make clear the set up in the neighbourhood of the bridge. Because of the possibility of the bridge being blown up before it could be seized a subsidiary dressing station was planned for the northern side of the river so as to make it unnecessary to transport all casualties to the south bank, where both surgical teams and the main dressing station were to be placed at the foot of the hills.



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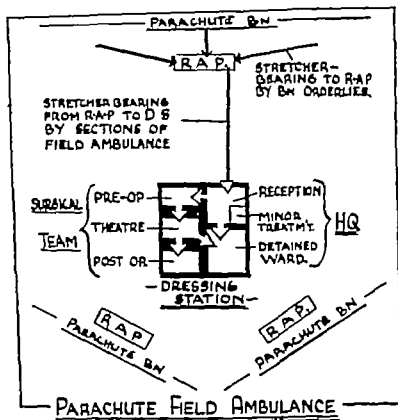


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The greatest difficulty was the shortage of medicines and dressing material. The High Command supplied the doctors with plenty of money, and they used it to buy even from the black market, mostly from Germans or their collaborators. The Germans permitted supplies to chemists, hospitals and other medical institutions, but only in limited quantities, so many new health co-operatives were created in order to get medical supplies. Very often the doctors were obliged to use the people's medicines. One of my colleagues told me that he used old white cheese instead of liniments. Penicillin was unknown. There were some supplies from the Allies.

The hospitals and the consulting rooms of private practitioners were the best places for intelligence service, and for contacting couriers. The whole medical organization in the Army and the country was used to facilitate the intelligence service. It was easier to admit a courier to hospital for one night and two days than to let him sleep in an hotel or private house.

In conclusion, this kind of secret medical service could be organized only when the population as a whole supported the resistance movement, or were, at least, against the aggressor, which was the case in Yugoslavia.

FEBRUARY 1944

## MEDICAL ORGANIZATION AND EXPERIENCES IN AN AIRBORNE OPERATION, SICILY

MAJOR C. J. LONGLAND, R.A.M.C.

*Surgical Specialist, Parachute Field Ambulance*

I propose to describe an illustrative operation from the point of view of a surgeon working with a parachute field ambulance.

First, let me refer to the medical organization of a British parachute brigade. Each of the three component parachute battalions has its medical officer, R.A.M.C. other ranks, and battalion stretcher bearers. Serving the whole brigade is the field ambulance, which, besides the commanding officer and headquarters staff, consists of four sections, each of a medical officer and nineteen other ranks and two surgical teams, each of one surgeon and six other ranks. There is in addition a dental officer capable of giving anaesthetics and co-operating in the treatment of jaw injuries. The field ambulance C.O. controls the medical activities throughout the brigade, and uses the components of his own unit as may be expedient.

Equipment is light, and largely confined to drugs, dressings, instruments, dishes and lighting and heating units, in addition to

zone. It took an abnormally long time to collect men and equipment, but we reached the prearranged building at dawn, other personnel of the field ambulance H Q. were arriving and the medical dressing station was got going although we found ourselves short of men and equipment owing to the scattered drop and to the loss of a plane ~~en route~~. The infantry were in a worse case, with the result that after preventing the blowing up of the bridge those available concentrated in the areas shown and prepared for defence. The planned C.C.P. on the northern side was never set up as this region was not defended by us, and its personnel had been dropped very wide of the mark.

At 9 a.m. on July 14 we had the first casualty on the operating stretcher and from then on the theatre was kept busy till late that night. During the morning as the enemy began to size up the situation, pressure was brought to bear on our position. In the afternoon heavy counter attacks developed and ultimately that evening the position by the bridge had to be abandoned and the M.D.S. was therefore uncovered. Fire in its neighbourhood during the day had made occasional hits but no casualties occurred in it. Despite the fire and difficulties of transport (stretchers were extremely scarce) considerable numbers of casualties were brought to the dressing station, which became filled to capacity. The enemy wounded were put in charge of a captured Italian doctor and dressings supplied to them. A few were operated on at his request. By 10 p.m. firing had died down and no further urgent cases were awaiting operation. The theatre staff after thirty hours of exertion of one kind or another, including the flight and the march, were going to sleep on their feet. The second surgical team had for the most part failed to arrive so that shifts were impossible the theatre was therefore closed and apart from night orderlies and a sentry everyone lay down for some sleep. The post operative cases were largely on beds, providentially found among a truck load of enemy medical stores near by the other patients in the dressing station were mostly on palliasses found in the building.

On the following morning shortly after an Italian colonel had visited us to make arrangements for our incarceration British tanks appeared on the scene, and more casualties arriving the dressing station set to work again. By 4 p.m. all cases had been evacuated to the rear and the station was closed down.

It is of interest to consider what was achieved by the medical personnel who actually took part in this operation their number was well below that planned but the number of combatant troops on the spot was also low. Of the value of the work done by the stretcher bearers and those engaged in first aid as always there can be no doubt. What of the surgical team? 35 cases were operated on with 2 post operative deaths before evacuation. Undoubtedly some lives were thus saved and wound morbidity reduced among the non-lethal

After one day's postponement the brigade took off from Sousse on the evening of July 13, and after a three-hour flight the drop began by the light of a half moon, soon much augmented by the numerous fires on the ground as ricks caught alight from tracer ammunition. Visibility near the Sicilian coast had become bad and many planes losing touch failed to drop their troops accurately. My particular plane made its correct landfall and we dropped close to the dropping

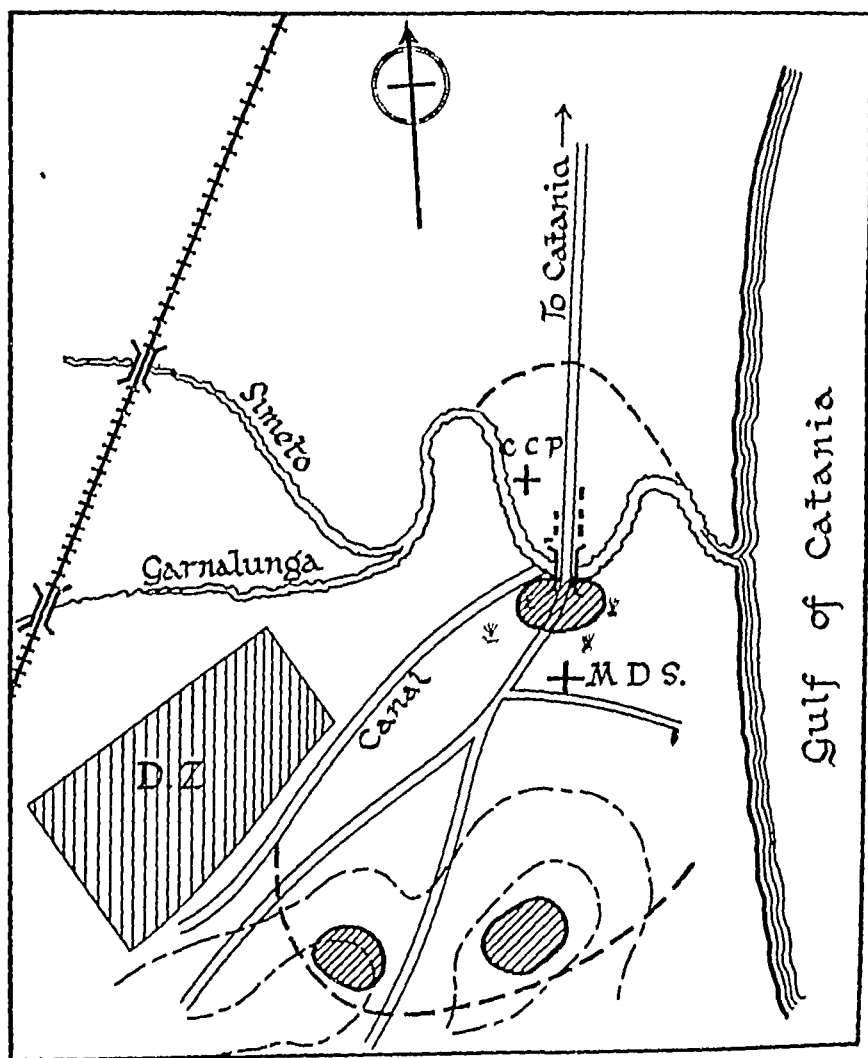



FIG. 2

- — — Proposed defended perimeter
-  Areas actually defended.
- M.D.S. Main dressing station
- C.C.P. Proposed secondary dressing station

On arrival at Lille food poured in through every available entry - gates, windows, over walls and this despite every German attempt to prevent it. Eventually they were made to see that this was bad for discipline and we were permitted to organize its distribution ourselves. While there every patient had a 'godmother' who regularly brought him food and comforts. The effectiveness of their efforts is shown by comparing the percentage of keratosis - respectively 31% and 63% of 147 patients from Lille and 87 unfortunates at Enghien - a prison hospital where no food was permitted from outside.

That was not all. These people continued to send food from France and Belgium at least until October 1941. Disregarding protests, a Dutch girl sent me a monthly food parcel for the whole of my captivity. No one can say too much for these people.

Finally, vegetable gardens supplied limited calories but gave vitamins, minerals and variety in the form of fresh lettuce, carrots, cabbages, beans and many other vegetables.

Other means of improving nutrition depend on organization and can be entertained only when the battle for control of the internal economy of one's own camp has been won. This was realized early and the majority of camps are now largely self-controlled, the Germans merely concerning themselves with security and routine discipline.

Weekly ration sheets were obtained and used for checking incoming rations. A record of food and its dietetic analysis was kept as a basis for complaint to the Germans or if this failed the Protecting Power.

Scales are essential but at first were unobtainable so we constructed our own from a beam of wood using 500 gm. pats of margarine as weights. The Unter Officer in charge was distressed when he saw this as he had a reputation for generosity achieved by returning, from time to time, a small portion of the rations that he had previously appropriated. The scales made a vast difference to the amount of food obtained and were shortly replaced by a regulation model.

Storage space and control of Red Cross parcels were important in that they permitted two things. Firstly one could build up and hold a reserve - valuable when parcels were delayed by transport difficulties. Secondly it allowed communal cooking, which effected a great saving on both food and fuel and gave greater scope for variety. Communal cooking was never popular with other ranks, who considered the parcel as their own and strongly resented such socialistic interference with private property. Meals with them were much more uninteresting and there was always difficulty in obtaining fuel for heating extra time.

A catering officer was appointed and the importance of this man cannot be overstressed as the appetite of the camp depended on his skill, industry and imagination.

Prisoners were weighed regularly and just before I left we made a nutritional survey. Weight had dropped an average of 17 lb with significant correlation with duration of captivity. This suggested that

wounds. Perhaps half of these cases were very materially benefited. To achieve this advance on the results of first aid a surgeon, a dentist and 9 other ranks (excluding those members of surgical teams who failed to arrive) with their equipment had to be transported to the scene of action. Which way does the balance tip? I have no hesitation in suggesting very strongly that the balance favours the use of surgery in these circumstances.

FEBRUARY 1944

## PERSONAL EXPERIENCES AS A PRISONER OF WAR, WITH SPECIAL REFERENCE TO DIETETICS

LIEUTENANT-COLONEL J. H. BOLTON, R.A.M.C.

The diet supplied by the Germans in prisoner-of-war camps has been inadequate throughout, averaging 1,700 calories a day with protein rarely over 40 gm (first grade 8 to 12) and fat about 50 gm. The highest obtained was 2,200 calories at Rouen when repatriation was expected – the lowest, on capture, being 1,200 calories. This produced a high carbohydrate diet inadequate in minerals and vitamins.

The most useful method of observation was an estimate of the proportion of cases showing follicular hyperkeratosis, an area above and behind the elbow being chosen as a standard site for examination. This figure was used throughout as an approximate index of general nutrition.

The legitimate sources of supplement are the Red Cross, occupied territories and vegetable gardens.

There should be no necessity for me to speak of the magnificent work of the Red Cross. Suffice it to say that they are intimately concerned in every aspect of prison life, that they keep themselves informed of nutritional needs and, by the use of scientifically designed food parcels, have improved the nutrition of prisoners of war to a level higher than that of any part of German-occupied Europe.

In a series of 98 cases studied the effects of these parcels were obvious in a month. Follicular hyperkeratosis fell from 66% to 40%, and wounds, general condition and morale improved dramatically. Hæmoglobin rose from 90% to 110%, and œdema completely disappeared.

Concerning the second source I will remember the women of Lille long after other incidents of my captivity are forgotten. Others will remember the women of Alost, Malines, Rouen and other towns in Europe where prisoners remained for a time or passed through. There is a debt here which can never be repaid.

the planes arriving the lighting of the signal fires and the aircrew stepping out of their craft to be met and feted by peasants in native dress.

Supplies were quickly unloaded and whisked up into hiding places in the hills, and patients loaded into the planes which quickly started on the return journey.

By this means we eventually moved about 1 000 patients to the comfort and safety of hospitals in Italy before a full-scale German offensive was begun. At this time the hospital was overrun. Fortunately only about 50 patients remained and these were hidden in underground bunkers, where they were found by the enemy, those who were unable to walk had their throats slit, the rest were taken prisoner and subsequently tortured. The nurses were raped and taken prisoner. Our supplies were found and looted except for the small amount we were able to take with us strapped to the backs of five horses. For the next four months we were on the run sometimes attacking always ambushing but most of the time retreating from the superior attacking force.

Now I had a chance to study at first hand the life of the Partisan army. Every day was intensely interesting in spite of the hardships. Each individual seemed an outstanding personality. There was never panic, and the most amazing cheerfulness. Classes were held for the children and uneducated peasants at every opportunity even within range of enemy guns. Singing and dancing were their two forms of relaxation. We travelled light, ready to move at a moment's notice, and equipped so that we could survive indefinitely if cut off from the main force. Behind us the enemy was carrying out a devastating scorched earth policy. The countryside was full of new graves, and at night the darkness was often lit by the fires of burning homes and villages. The discipline was inconceivably good - absolutely forbidden was drinking gambling and immorality. There were no salaries paid to members of the Partisan army who considered themselves fortunate if they had enough to eat and to wear. All nationalities and creeds were firmly united in an almost fanatical desire to liberate their country and all were willing to sacrifice everything to this end. They rose in rank by ability with no discrimination between sexes. I have seen a battalion commanded by a woman, her husband in the ranks. Battalions of small boys were trained as saboteurs because of their agility and great numbers of them were killed.

Everyone travelled on foot horses were used to carry equipment and wounded. These faithful creatures suffered terribly from overwork and lack of food and had tremendous saddle sores. The endurance of the Partisans was beyond belief - men, women, and children. Long gruelling marches by day and night, lack of food and clothing - and for many of them it had been going on for years. One could not but



flaged bunkers, in a damp and dark situation, with little food or water. All had severe war injuries which had received very little treatment, due to lack of supplies, doctors and nurses. Some of them were literally just bags of pus. Most pitiful of all was the fact that about one-third of the patients were women and young boys. For by the beginning of 1944 nearly 25 % of the Partisan army consisted of women, a fact unique in the annals of war. The death-rate in the hospital was about six per day. The colonel in charge was an excellent surgeon, but elderly and almost worn out by the strain of the overwhelming difficulties under which he worked.

The day after our arrival our equipment was moved in. We cleaned and re-equipped the operating theatre and started to work. One of my sergeants was a trained anaesthetist, the other an operating room supervisor. We had no fully qualified nurses, but in the operating theatre were three Partisan nurses, who had had their training on the battlefield, all excellent workers and quick to learn. By working from early morning until dusk we were able to average about fifteen cases a day – war wounds of every type and nearly all major surgical problems.

The Partisans were superb patients, seldom complaining, cheerful under adversity, singing folksongs, sometimes even on their death-beds.

They were most grateful for our efforts, and we were soon taken completely into their confidence from the General down. Some of these wounded had been carried around for over a year, a tremendous task for an army on foot, and greatly cutting down the mobility and striking power. The weakest part of a guerilla force is its hospital unit, and the Germans were quick to capitalize on this.

After two months in the village we moved our hospital into tents, improvised from captured Italian ground sheets. Wooden bed-frames were built with springs of parachute strapping and mattresses of parachute silk stuffed with straw. A mountain stream, piped and heated, provided showers. A Flying Fortress which crashed near-by provided much material – rubber sheeting, aluminium and electrical apparatus. In all, it was a 200-bed hospital, as well equipped as a British casualty clearing station. One ton of Red Cross supplies provided comfort and healing for hundreds of patients.

For nearly two months more we were unmolested, and supplies of arms, food and clothing were dropped almost nightly. An airstrip was cleared near-by, which the Partisans could hold with difficulty for about three days at a time, where six to eight planes could land by night with supplies, and evacuate wounded on the return trip – about 45 patients in each plane.

It was a unique experience to watch the hopeful, expectant faces of these half-clothed patients (all possible clothing having been retained for future use) waiting in the moonlight at the edge of the field, with continual fighting going on in the neighbouring hills, the sound of

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It was a unique experience to watch the hopeful, expectant faces of these half-clothed patients (all possible clothing having been retained for future use) waiting in the moonlight at the edge of the field, with continual fighting going on in the neighbouring hills, the sound of

all was not well. The demands made on the health services were so great and so urgent that a complete breakdown might be expected unless help were forthcoming immediately. A high ranking Army officer was entrusted with the organization of supply and a senior medical officer appointed as medical adviser. Eight majors of the I.A.M.C. were appointed as deputy assistant directors of hygiene to the eight worst affected districts. Fifty two junior officers were trained in preventive work and appointed to work under them as sub-divisional health officers. One thousand bedded general hospital, two field ambulances, and one C.C.S. were drafted in and being tented units, they were broken up to form twelve one hundred bedded tented hospitals and eighteen mobile treatment centres.

Several Indian infantry battalions, detachments of R.I.A.S.C. and Pioneers were seconded with transport for famine duty. On them was placed the responsibility of guarding and moving supplies, rehabilitating country boats, restoring road communications and acting as agents in noting and passing information concerning local famine conditions and outbreaks of epidemic disease.

In order to combat the wholesale outbreak of epidemic cholera and smallpox a mass inoculation and vaccination campaign was organized with a target of 8 000 000 vaccinations and inoculations in three months. Malaria was controlled by the wide distribution of quinine. Fifteen grains daily for seven days helped to suppress the fever and make life tolerable. There was no time for widespread drainage schemes and spraying. A quick result was demanded. Serious difficulties were encountered. Those taking part in the campaign had to live among disease-stricken people and were often hard put to it to feed themselves and find suitable drinking water. Casualties from sickness were frequent. The public feared inoculation and vaccination and their natural fear was augmented by subtle Japanese propaganda to the effect that these injections were given by the Army to weaken them and so keep them in subjection. When a team arrived in a village after perhaps two hours walking in the sun carrying their equipment, the village would be found empty of inhabitants, saving one or two old or infirm people who could not run away.

It was contrary to orders to use any force but officers soon found they had to devise their own methods of persuasion. A successful technique was to picket the outlets of a village by a few unarmed Rajputs or Baluchis and though no force was used the presence of a large whiskered Sepoy was sufficient to deter those who sought to retire to the jungle. A little persuasion, joke cracking and quinine distribution usually gained a few volunteers for inoculation. When they were seen to survive, others followed and finally access would be obtained to the women's quarters and with veiled faces they submitted their arms for the needle. Much depended on the patience, resource

the population. Sanitary arrangements were impossible to control. Tube wells were too few and many were out of order and could not be repaired due to shortage of materials. The large ponds were used for all purposes, drinking as well as washing and there was every indication that epidemics of cholera and smallpox might be expected to sweep over Bengal and possibly all India on a scale never encountered before. As Bengal was a great military base and the main line of communication for operations in Assam and Burma the effect on the war effort of any large scale epidemic can be imagined.

A further disturbing factor was the fact that the soil was well prepared for anti-British propaganda inspired by the Japanese. The people were made to feel that their British masters willed this disaster in order to weaken them and so keep them in subjection. The Army was unpopular because it was thought that the cause of the breakdown was the diversion of large stocks of rice for the benefit of the soldiers. This of course had no foundation as the troops were largely Punjabis, Rajputs and British who did not eat rice in any quantity. In short the problem of famine relief became not merely a humanitarian project but a political and military concern of the highest consequence.

*Action taken by Provincial Government* – The measures taken by the government to meet the emergency were manifold. Apart from importing and distributing grain and medicines, camps were organized outside the cities to house destitute people, segregate them, rehabilitate them and finally repatriate them. Destitute homes, orphanages and workhouses sprang up all over the country districts. Clothing was distributed and famine hospitals erected. Independent organizations such as the Missionary Societies and the Communist organization cooperated effectively.

As the famine dragged on and relief was only of stop-gap proportions, disease became more and more prevalent. The destitute people suffered from inanition to such a degree that a meal would kill them, and intravenous and nasal drip therapy was required. All this required hospitals.

In November 1943 there were in Bengal, with its population of 50,000,000, only 7,400 hospital beds. A large proportion of these were in Calcutta itself which meant that in country districts there was one bed per 8,000 of the population. By December an additional 13,000 beds were made available by the construction of famine hospitals and that number was doubled early in the year. Temporary buildings made of bamboo and matting were run up and extra medical personnel were recruited.

One hundred and twenty-eight doctors, five hundred and fifty sanitary inspectors and over a thousand health assistants were trained and put into the field.

*The help given by the Army* – In October 1943, on his appointment as Viceroy, Lord Wavell paid a visit to the famine area and found that

*Hospitals* - The military hospitals loaned for famine duty were tented units capable of breaking up and functioning as 100-bedded sections. The policy was to open up a section hospital rapidly, in an area where there was great suffering due to disease superimposed upon starvation. These sections were capable of expanding to two or three hundred beds if the civil authorities erected temporary buildings. The most profitable work was done where the Army ran the hospital, expanded as above, with the help of civilians recruited by the district magistrate. When sufficient doctors and nursing attendants had been found and trained and the pressure began to relax, the military staff with their tent were removed to an area in which a new need had arisen, the civil authorities continuing to run the famine hospital.

A typical example of the mobility and resources of the military units was shown when a sudden emergency arose on a large island on the Ganges delta. The population of 160 000 had but one small hospital of twenty beds. A delay had arisen in the erection of the famine hospital due to lack of materials and the difficulty of shipping them. The situation became critical owing to the great increase of sickness on the island. A military tented hospital functioning on the mainland was struck, packed and loaded on barges. The barges arrived early one morning and the entire equipment had to be transhipped by the orderlies on to country boats to proceed to the centre of the island by a water channel. One of the country boats containing the iron beds overturned and the beds went to the bottom. The officers and orderlies went in after them and salvaged them all and by nightfall the entire tentage, bedding and equipment had been unloaded at the site. Erection of the tents commenced the next morning and by 4 p.m. the same day the hospital was complete and eighty patients were in the beds. The civil famine hospital was completed a month later and the military unit withdrawn.

#### *Diseases Encountered*

Three types of patients were treated in the hospitals

- (1) Those suffering from starvation only
- (2) Those suffering from starvation plus disease.
- (3) Those suffering from acute disease.

*Insolation.* - Those suffering from acute starvation could be divided into four groups

- (1) Collapsed cases likely to die unless nourished by parenteral methods.
- (2) Collapsed cases capable of taking fluids by mouth.
- (3) Cases capable of taking a simple milk diet.
- (4) Cases likely to be able to look after themselves in a few days.

and tact of individual officers. Some achieved astronomical results; others were less successful.

A further difficulty was to ensure that quinine was actually taken by those for whom it was intended. When the villager found that quinine tablets had a money value he would collect as many as possible for himself and his family and promptly sell them in the black market. So common was this practice that most officers in charge of mobile treatment centres and hospital outpatients made the villager swallow the day's supply in their presence and by working on one area for seven days they were able to ensure that the total dose reached its destination.

It became obvious that the target of 8,000,000 could not be attained by the limited resources of the Army alone and medical students from Calcutta were asked to volunteer. The response was good and they were organized into teams and equipped with swift remedies and stocks of cholera vaccine and lymph. They worked in our centre for a week and during that time generally succeeded in protecting 50% of the population and got a complete course of quinine into the malaria sufferers. Being Bengalis themselves and not being in uniform, they were able to gain public confidence quickly and some of these teams did excellent work. The net result was that the target of 8,000,000 was far exceeded and over 10,000,000 had been protected by the end of March. As a result no serious epidemic occurred and the situation came under control.

At the height of the campaign it became evident that the forces of non-cooperation were working to stir up public hostility. On several occasions officers and sepoys were interfered with in the performance of their duty and on one occasion while inoculating and vaccinating in a large market an officer and two orderlies were set upon by an organized mob and badly beaten up. The situation called for delicate handling. To take severe disciplinary measures against the village would give the matter undue prominence and would only precipitate an outbreak of opposition and hostility to the Army and its relief work, breaking down at a stroke the confidence so hardly built up by weeks of patient work. On the other hand to protect the teams by armed guards would provide the Japanese with an opportunity to say in their propaganda that the British were pumping poison into the people of Bengal at the point of the bayonet. A senior officer approached the leaders of the community in which the disturbance occurred and reasoned with them, pointing out the folly of such behaviour. In the end, he succeeded in getting them to promise to maintain order among their own people if he would come himself and carry out the inoculations at the next market day. On the appointed day, the officer and two orderlies arrived with bags of sweets for the children and cloth for the old and infirm and the public queued up and received their prick and no more was heard of disturbances or riots.

- (2) Cholera.
- (3) Bacillary dysentery
- (4) Amoebic dysentery

It was not possible to have laboratory diagnosis carried out in the more remote hospitals and a hit or miss method of treatment had to be instituted. All acute diarrhoeas were treated as cholera with opium and essential oils and intravenous saline if collapsed. When the acute phase had passed and the condition did not improve sulphaguanidine 3 gm. was administered followed by 1½ gm. four hourly for forty-eight hours. If the condition still failed to respond amoebic dysentery was suspected and a course of emetine instituted. It was unscientific and perhaps haphazard but the diagnosis often had to be made and the treatment carried out by a very junior officer with limited facilities in the most trying conditions.

*Skin conditions* - The lowered nutritional state of the skin led to an enormous increase in scabies and skin infections. Phagedenic ulcers were common and resistant to treatment. Scabies was rampant and indents of sulphur ointment were by the ton. Nephritis was a common complication of infected scabies.

*Cholera and smallpox* - Cholera and smallpox cases were not usually admitted to hospitals except in collapsed states. The lack of sufficient nursing staff made it difficult to look after them and as they did fairly well if looked after in their own homes by their own relatives, the policy was to protect the contacts by inoculation or vaccination and visits were paid by the medical staff to houses.

*Deficiency diseases* - Frank cases of scurvy and beri beri were not common. Millions of vitamin B tablets were distributed and people were often driven by extreme hunger to eat roots and herbs and the husks of rice thereby acquiring vitamins B and C. Fish could be caught easily in ponds and channels and thus their requirements of vitamins A and D were provided for.

### CONCLUSION

The Bengal famine was a tragedy and disaster of the greatest magnitude but it may have its blessings if it has taught the common people to eat other grains besides rice and has shown the folly and vulnerability of a race living on one staple article of diet. Also there has been a great development of hospital mindedness among the country people. For the first time in its history Bengal has seen and valued well run hospitals in the country districts and the public health problems thrown into prominence by the famine may lead to great post war developments in curative and preventive medicine. The public mind is at least prepared to receive them.





hospital, depending on a pump in the grounds for water and on paraffin lamps and candles for lighting. Rumour was rife and the 2 Army eagerly awaited.

One day I accompanied a German medical officer to some British dressing stations in the suburb of Oosterbeek. They had been constantly changing hands, being situated in an area for which both sides fought hard and on this day were more or less in German hands. It was here that one of the great impressions was made on me: it concerned the behaviour of the casualties in these dressing stations. To take a typical case: we entered a room in a small house and found in neat lines on the floor the wounded on stretchers. They had been hit some days previously: their rations had expired early and water was not easy to come by. They had been in the middle of a battle now famous for its ferocity, day after day, with little respite, and unable to move themselves to better cover. The house had been hit and the medical orderlies looking after them were wounded themselves: and yet they were all perfectly cheerful and composed and gave no sign of what they were going through: such universal courage under such continuous stress was a wonderful thing to see.

A local armistice was arranged and many of these wounded were got back to St. Elizabeth's, and to a barracks at Apeldoorn allocated to us by the Germans for use as a prison hospital: operations, no longer early, were done for them. At first we did not appreciate how nearly at the end of their tether some of them were: and disasters on the operating table were with difficulty avoided: we soon learned our lesson and with the aid of blood from Dutch volunteers in apparently limitless quantities, and other measures, they nearly all survived this phase. I know one of my cases had at least 14 pints of good Dutch blood. Many of our cases at St. Elizabeth's on the contrary had been operated on early: we soon had ocular proof of the efficacy of early wound surgery as we watched the progress of the two classes over the next week or two.

From Apeldoorn as they became sufficiently fit the wounded were taken to Germany. The medical staff became redundant and we made plans for escape. I and three others were among the first to get out through the wire one dark night, and two days later we made contact with the Dutch Underground which henceforth took us under its very efficient wing.

We lived for five weeks with a Dutchman, his wife and little daughter who cheerfully risked their lives daily at this dangerous game of hiding Allied troops, until an organized attempt at crossing the Rhine to our own lines, brilliantly organized by the Underground, met with failure in the shape of some German sentries: we were mostly recaptured, some being killed and wounded in the process.

Some of the events which made deep impression on my mind have been described: there were many others too numerous to mention.

Lastly there has been a big swing over from suspicion of and hostility to the Army in Bengal. Never has the reputation of the British and Indian Armies stood higher in the minds of the common people and that in itself is no small factor in the war effort while Bengal remains a base and the main line of communication to the war in Burma.

MAY 1945

## EXPERIENCES OF A MEDICAL OFFICER WITH A PARACHUTE UNIT AT ARNHEM

MAJOR C J. LONGLAND, R.A.M.C.

*Surgical Specialist, Parachute Field Ambulance*

I have just returned home from a German prison hospital, and I have been asked to give you some account of the experiences at and after Arnhem of the parachute unit with which I was a surgeon. I have nothing erudite to say on the subject of surgery, but several profound impressions have been left upon my mind as a result of our experiences.

Our landing on the afternoon of Sunday, September 17, 1944, left nothing to be desired, thanks largely to the previous thorough bombing and strafing by the R.A.F.; we reached our particular objective, St. Elizabeth Hospital in the western part of Arnhem, a little later than we expected, because of the strength of the opposition encountered as the brigade we were with forced its way into the town.

The hospital welcomed our arrival about midnight enthusiastically and gave us all the accommodation we needed and we set to work there and then. Next morning we found that the operation was not going according to plan and the hospital was recaptured by the Germans.

For the next few days chaos reigned, and confused fighting fluctuated in the streets around us. Inside the hospital we treated casualties as they were brought in by both sides and by Dutch civilians. We were hit from time to time and suffered a few casualties. By the fourth day it seemed clear that the enemy were firmly in control of our neighbourhood. The Germans had marched off most of the unit when we were first captured, leaving only the two surgical teams; we were steadily receiving casualties and were in consequence short of men to look after them. In this impasse the Dutch staff came to our rescue, and I believe every one of the nurses volunteered to stay on and help us, battle or no battle, so that between us we were able to give good treatment.

Though for a week the Germans made no attempt to guard us we were a completely isolated community, fed by the reserve food in the

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# Organization and Treatment in German Military Hospitals

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and together they add up to a monument to the devotion shown by the Dutch civilians to us and to the cause we represented, liberation.

Being liberated, as I myself was a month ago, was another moving experience, not so much from a personal point of view as a recent prisoner, but to witness the cherished hope of years coming true to men of many nationalities and status in a prison hospital. There was no wild delight and little demonstration even among the less stoic races. They, as it were, awoke from a dream into the light of day and rubbed their eyes.

# EXPERIENCES OF GERMAN MEDICAL SERVICES AS A PRISONER OF WAR

MAJOR A. S. TILL, R.A.M.C.

The impressions of the German Medical Service which follow are those of a prisoner of war in the years 1943 and 1944, after capture with a Field Surgical Unit on the island of Cos in the Dodecanese, and later when working in a P o W hospital in Germany.

The German medical arrangements for the invasions of Cos and Leros were surprisingly lacking in personnel, equipment and organization. No medical unit was landed with the invading troops, and there was a quite inadequate number of doctors and medical orderlies. They had no facilities for operating on their own casualties, so that it fell to our lot to treat all wounded in this area. Six weeks later, on Leros, where the Germans had expected and sustained heavy casualties, many of their wounded were treated by British medical units captured there, and in addition 450 seriously wounded were evacuated to Cos without any previous warning. No accommodation other than a church, some straw filled outbuildings, and the open air were available there, and there was no surgical help except our own and a young German surgeon recently arrived. The resulting confusion can be imagined. Most of these cases had had no treatment at all for four or five days. They were in a bad way and were no credit to the organizer of the medical side of the invasion.

The military training of German doctors differs a good deal from our own. Three months' drill on the square precedes their appointment as R.M.O. which in the first instance carries the rank of warrant officer. Many of their M.O.s were unqualified medical students, or had had their clinical training curtailed by the pressing need of the Army or the closing of Universities due to bombing. They were surprised that we had specialist anaesthetists and full time resuscitation officers, which they themselves had not got.

The medical orderlies, who incidentally were all armed with automatics or rifles, worked hard but had evidently had little training. Most of these orderlies, who it must be remembered were with front-line troops, were of low medical category. One had active pulmonary tuberculosis, another had recently undergone a partial gastrectomy and several were tuckered leave men, who had been released from prison for conscription in the Wehrmacht. One showed us his papers from Dachau.

The medical treatment meted out by the Germans even to their own wounded was not good by our standards. They did not think that



actually brutal. Their interest in cases sometimes showed a despicable discrimination between nationalities. P o W hospitals were obviously staffed by a poor type of German doctor though some of the consultants who occasionally visited the camp were helpful and the surgeon under whom I worked was always correct in his dealings with his patients and ourselves. German ideas of treatment did not always agree with our own and often required tactful adjustment. Their management of war wounds was certainly greatly inferior to that to which we were accustomed at home.

Any alleviation of the lot of the P o W patient in hospital was due to the Red Cross, and to the prisoners themselves and the Allied medical orderlies who worked devotedly under difficult circumstances, rather than to the Detaining Power.

The German Commandant often informed us that *Die deutsche Medizin steht sehr hoch*, but from my experiences during the war I have yet to be convinced of this.

FEBRUARY 1945

## ORGANIZATION AND TREATMENT IN GERMAN MILITARY HOSPITALS FOR PRISONERS OF WAR

CAPTAIN AUSTIN G HEWER, M.O., R.A.M.C.

I was a prisoner of war for exactly four years and one week and was, therefore able to see a certain amount of German medical organization in different phases. I hope I am not biased against the Germans and their medical work by having been in *Gefangenschaft*, but it must be understood that a prisoner of war has only limited opportunities of seeing German hospitals and German medical work.

*First stage* - When we were first captured in 1940 we saw the Germans in a triumphant phase, with the inevitable display of bombast and forced efficiency. Certain factors did impress us at this time, including such things as their mobile surgical equipment, completely self-contained which moved up rapidly with their forward troops and which were provided with ample personnel who obviously knew their job. We noted also their ambulances, which appeared to be of extremely good design, and there were plenty of them. Altogether we thought their medical organization well rehearsed. Incidentally it was in that phase that I had my only experiences of Teutonic abuse and personal aggression which lasted a few weeks.

At a later phase these signs of efficiency would not have made the least impression on us when we had had time to get used to the British methods which were coming into force.



blood and plasma transfusion was really a practicable front-line procedure, and got very worried if we ever gave more than half a litre of blood. I saw no attempt to give proper prophylactic courses of sulphonamide. Their paper bandages were hopeless for profusely discharging wounds. On several occasions anaesthetics were dispensed with, though we had good supplies to hand.

We were particularly struck with their lack of interest in elementary hygiene. No latrines were dug for days, and some hundreds of soldiers, prisoners, and sick were allowed to defæcate anywhere around the hospital buildings. The wards attended by the German M O s were often filthy, with stale food, discarded dressings, and blood-stained uniforms and equipment lying about. Black clouds of flies surrounded the dying, and inevitably most of us developed diarrhoea.

Conditions in P o W hospitals varied. In my own case I worked for some time in a predominantly French camp, which included, however, prisoners from all the Allied Nations, and some women and children. The total population with satellite working camps was about 60,000.

Each nationality had a sick bay or 'Revier' of about 20 beds, where enormous sick parades were held daily, and minor illnesses were treated with the very limited facilities. We were often obliged to look after the more seriously ill patients whom the German M O had refused for admission to the hospital proper. The hospital itself was a wired-in compound containing long wooden huts accommodating about 1,000 beds, and looked after by six German and fifty Allied doctors. The life of a patient in hospital was certainly easier than in the camp, but from the medical point of view it still left much to be desired, compared with the treatment German prisoners get in British hospitals.

Beds or double bunks with clean covers were provided, but fuel was scarce and the light too dim to read at night. All admissions and discharges were bathed and deloused. Food and medical supplies were inadequate, especially dressings, plaster of Paris, sera, and sulpha drugs. Fortunately Red Cross parcels were in good supply at that time, and for many made the difference between life and death. The operating theatre and aseptic theatre for doing minor operations were well set up for ordinary general surgery, much of the equipment had been brought from France. Gloves and linen were limited and the German surgeon habitually operated on four or five cases wearing the same gown and gloves. The X-ray room with a fluoroscope, and a laboratory for simple investigations, run by a Russian doctor, completed the establishment of the hospital. Documentation of the patients was good, and was carried out by prisoner interpreters who translated the notes of six different languages into medical German.

Of the German doctors with whom we came in contact, some were reasonable and painstaking in their work, but the younger ones were often ignorant and arrogant, and their elders not infrequently had little interest in the welfare of their prisoner patients, and at times were

say, and the German medical officers seemed to consider our keenness in this both unnecessary and surprising. We gathered that they relied more on saline solutions than on blood.

The supply of sulphonamides was very limited, and almost entirely confined to a sulphanilamide preparation known as cubann.<sup>1</sup> We were again largely dependent on the British supply for this group of drugs. We could not obtain from the Germans any information of any of the later sulphonamide preparations, and I do not think that they were using any of the new ones for their own wounded at that time.

There was one antiseptic solution known as rivanol<sup>1</sup> which appeared to be in general use in any hospital that I saw. It was, I believe, a flavine solution, and seemed quite effective and useful for general work.

We were able to obtain fairly good quantities of plaster of Paris bandages, and, on the whole, the quality of this was good. I think we employed plaster work more generally than the Germans.

With regard to diphtheria, of which we had a number of cases, especially among the French, we were told by the Germans that 8 000 units of antitoxin was enough for any case, but we managed to overcome this difficulty, and obtain further supplies by various means.

Equipment against typhus was non-existent from German supplies, and we relied entirely on the outfits and prophylactic measures promptly supplied from home and sent us by air. I believe the Germans were astonished at the things sent us, and seemed surprised at the measures we took.

There had been an outbreak of typhus at this hospital before I arrived. A number of our German guard, and the German doctor in charge of the hospital, died as well as a good number of the Russians. Eight of our twenty two British orderlies caught it, all of whom recovered. The Germans and the Russians seemed to be specially susceptible to the disease, and we learnt from a German medical officer some of the typhus conditions on the Russian front and the measures taken to deal with them. We were told, for example, that they used atabrin and intravenous calcium gluconate, but little could be done in segregating the cases during an outbreak.

It was here that I saw real famine oedema amongst the Russians. A number of them were brought in dying of starvation, and it was only after losing several of them that we learnt a method of feeding that prevented further deaths in our small hospital.

In a near-by Russian camp consisting of many hundreds of Russian troops we were told that a huge percentage of them had died of starvation within the space of a few months. Of course I cannot vouch for this myself, but we later learnt from the Russians themselves of events of even more distressing character which can never be forgotten. As far as we could find out there were no medical arrangements in the camp and I believe few Russian doctors were allowed to

<sup>1</sup>See later paper by Dr. F. H. K. Green, page 397

*Second stage.* — For the next few months, three of us were in charge of some three to four hundred British wounded in Belgium. We were working in a converted school building, and dependent almost entirely on medical supplies we had obtained from British ambulances, receiving no help from any German source. Their medical organization consisted mainly in harassing us to send on as many cases as possible to the working camps, and throughout, all of us, including all the wounded, were deplorably short of food. We realized early why wounds failed to make any sign of healing, why fractures were very slow in uniting, and I saw for the first time hunger oedema. I think I can fairly say that at this stage, following the invasion and fall of France, no medical organization had been worked out by the Germans for prisoners.

Towards the end of 1940, as the result of the good help of the American authorities in Germany, we were all moved out of Belgium into Germany, and there our wounded were able to come under better organization, as they were put into camps in which much of the medical supplies were provided by means of the British Red Cross. Prior to this, had it not been for the good offices of our Belgian friends our wounded would have fared badly indeed.

*Third stage.* — I spent the next short stage in Poland, where the German organization was negligible. In a large camp and hospital we were to a great extent dependent on our British supplies for treatment. The war with Russia was obviously occupying the German medical personnel almost wholly as far as we were concerned. We received no help from them whatever that I can remember, and one of our main concerns was the possibility of an outbreak of typhus, for which we saw that no provision had been made by the German authorities.

*Fourth stage.* — From Poland I was moved to Thuringia, where, with three other British medical officers, I worked in a hospital. I was there a considerable time, and I was able there to learn most of the German military medical organization. The hospital contained about three hundred beds, and our patients were Americans, British, Russians, French and Serbians. Far from being prejudiced, we were prepared to be impressed by German organization and equipment, of which we heard much, but at no time did we see anything of any outstanding merit whatever. We had the use two mornings a week of the operating theatre of the local hospital, but the equipment of this place, which the Germans thought highly efficient, would here be considered mediocre. They had a fairly good X-ray outfit which we used a good deal, but in the surgical work we used British equipment almost entirely. While here, we had about one hundred of the Dieppe Canadian wounded brought in, and we were most thankful for the supplies which we had asked for, and which had been so promptly sent us by the British Red Cross.

With regard to blood transfusions, the Germans had very little to

## CAPTURED GERMAN MILITARY HOSPITALS

LIEUTENANT-COLONEL CHARLES H. ARNOLD M.C. U.S. ARMY

The remarks and opinions in this discourse are based first on personal observations in the Brest area, the Brittany Base Section, Oise Base Section, and in the advanced areas particularly in Belgium. In addition to personal observation, information has been obtained from American and Allied surgeons, as well as from German military prisoner-of-war surgeons and their corps men. It is interesting to note that from each source practically the same information was obtained all of which supports the opinions of the writer.

The general physical condition of most prisoners of war is below that of the average American soldier. The routine physical examination given each prisoner-of-war when he is processed established the fact that the average physical status of the German soldier at the front during the last half of 1944 to the present is decidedly inferior to that of our men. Especially bad physically were the Russians, Poles, Italians, and others fighting in the German Army.

The physical status of prisoners-of-war taken recently is definitely lower than that of those taken two months ago. Prisoners have been taken during the last week near Bastogne from special battalions for specific deficiencies — a battalion for the deaf, one for gastric ulcer etc.

A twenty-four-year-old prisoner-of-war battalion medical officer stated that their medical supplies were adequate, that weekly inspections were made for lice, physical fitness, etc. and that their principal diseases were bronchitis, rheumatism and colds. He stated that they had plenty of well-trained medical officers. Enlisted men briefed the same day did not agree with the medical officer.

Many cases of infected compound fractures were treated by irrigation and not by closed cast method. Sulfa drugs are used by them but I failed to find anyone who had heard of penicillin.

No partiality was shown by us in the care of their sick and wounded. Plasma, blood penicillin, etc. were used where indicated and emergency operations were performed promptly. I understand that their policy has been essentially the same in so far as their supplies would permit, likewise aid men in the field both American and German, render service to each other. Prisoners-of-war nurses taken last fall in Brittany were of all ages and were nearly all nurse aids.

Men who had trench feet on the Russian front one or two years ago and were taken on the Metz front in November did not respond to treatment as the fresh cases did. Incidentally in my opinion a case of trench feet of hospitalization severity should not be exposed a second

work as medical officers or in any medical capacity, and they were sent to the salt mines as ordinary prisoners

*Fifth stage.* — During the next phase in 1943, the German personnel in our hospital were one day specially paraded and given certain orders. We were able to find out afterwards that orders had been received direct from Berlin that henceforth the British prisoners were to be treated reasonably and correctly, and this made our routine definitely easier.

It was also at this time that in this hospital we were receiving batches of American and British bomber crews from time to time. They came in from German hospitals in France and the Netherlands, having in most cases been brought down a week or two previously. They were in the main seriously wounded, and they used to arrive after two or three days' journey in railway vans attached to goods trains. We always made a point of meeting them at the station with as large a force of medical orderlies as we could get together, as we had to carry them a considerable distance on stretchers, no other transport being available. Here, I may say, the Russian, French and Serbian orderlies vied in their keenness to render any possible aid to their Allies, and defied completely all German efforts to discourage any sign of friendship and good feeling towards the Americans.

These wounded coming from German hospitals were accompanied with voluminous medical notes, but very neglected wounds. Most of them had been X-rayed, and the X-rays came with their notes. From them we heard much of the overcrowded military hospitals with German wounded, and the obvious shortage of German medical personnel.

#### CONCLUSION

In the very frequent discussions that we had among ourselves, we came to the conclusion that there was nothing of any outstanding merit in the much-vaunted organization of the Germans. This conclusion was amplified by the discussions we were able to hold very occasionally with German medical officers. We learnt, too, that the Germans were very hard pressed for hospital accommodation for their own wounded, and that there was a definite shortage of medical officers. I believe they had great difficulty in the supply of artificial limbs for their own wounded, and that accounts for the British amputation-cases having received no artificial limbs for three years, except such as we ourselves put together for them.

We British medical officers made deliberate efforts to guard against prejudice and antipathy towards the Germans, which might have been detrimental to our work, but we were disappointed at being unable to gain new experiences of medical methods from the enemy, and I believe they had little new to contribute towards military medical organization.

information which might be relevant to the proceedings of the Conference, the Chairman kindly invited me to attend.

I will refer briefly to some of the German medicaments. Eubasin is a German trade name for sulphapyridine. Rivanol is 2-ethoxy 6 g-diaminoacridine lactate. 'Rivanol' appears to be a very popular wound antiseptic in Germany. It has been tested in Britain by Professor J. McIntosh, who considers it less satisfactory than proflavine, at least for the treatment of experimental anaerobic wound infections in animals. The German S.E.E. analgesic mixture consists of scopolamine, eukodal and ephetonin. Eukodal is a morphine substitute (dihydroxy-codeinone hydrochloride) and ephetonin is synthetically prepared ephedrine. German surgeons apparently use the 'S.E.E.' mixture for minor operations, for which British or American surgeons would use thiopentone soluble (pentothal sodium).

The German publications to which the Medical Research Council have had access support the view expressed by previous speakers, that blood transfusion, and serum or plasma infusions have been used much less by the Germans than by the Allies, and that German surgeons seem to have a rather widespread fear of transfusions exceeding 500 c.c. in volume. Among the artificial blood substitutes tried by German workers have been tutofusin, a crystalline solution, and periston, described as a pharmacologically indifferent colloidal solution which will persist in the blood stream for twelve hours. Details of an improved form of periston known as periston 35 were published in the German literature in 1943 but there are indications that it did not prove really satisfactory and was used only because of a shortage of plasma.

The principal novelties in German war surgery indicated by the literature have been the application of 4-aminomethylbenzene-sulphonamide (marfanil) for the local prophylaxis of gas gangrene, and the use of the Küntscher nail to unite fractures of the shaft of the femur or humerus. Marfanil is a drug of the sulphonamide type, which was originally prepared by American chemists, but discarded by them owing to its poor effect against streptococcal infections in animals. It is active *in vitro* against the organisms of gas gangrene and against streptococci (including sulphonamide resistant strains). It has the advantage of not being antagonized by the presence of pus, but it is quickly inactivated in the presence of whole blood. It is thus of little use when given systemically but it may have advantages for the local prophylaxis of wound infections. German surgeons have used it chiefly in combination with sulphanilamide as marfanil-prontalbin powder for local insufflation on wounds. The Küntscher nail has been the subject of a number of German publications abstracted in the *Bulletin of War Medicine*. In a paper published in Germany in 1943 it was claimed that this appliance had revolutionized the treatment of

time but be sent to another theater or held here as a replacement after the cold weather has subsided.

A lower standard of medical care is constantly reflected in the prisoners-of-war. In the large prison camp near Brest where 33,000 were held for a short time, following the fall of the port, German medical officers were made use of temporarily to hold sick call and run a dispensary with a few dozen beds. It was necessary for us to order the transfer of a number of these patients to a hospital although the German medical officers felt that the care they were receiving in the dispensary was wholly adequate.

The U.S. medical officer in charge of the dispensary near Bastogne stated that the prisoners-of-war were generally dissatisfied with their own medical officers and preferred ours, that 10% of all prisoners-of-war are on sick call as soon as they enter the enclosure and most of this number are immediate hospital cases. He stated that 100% are lousy and 75% have scabies.

The condition of the hospitals which we captured from them was invariably filthy. Plumbing was out of repair in most instances as well as heating plants, electric wiring, and other equipment.

The poor training, lack of skill and evidence of irresponsibility of their medical officers are reflected in the unsatisfactory care of their sick and wounded.

FEBRUARY 1945

## GERMAN LITERATURE ON MILITARY HOSPITALS

F. H. K. GREEN, M.D.

*Medical Research Council*

After listening to the very interesting, and sometimes tragic and gruesome stories told to the meeting by speakers with first-hand experience of German military hospitals, I am diffident of contributing to the discussion, since my own information must be regarded as no nearer than third-hand. It is derived chiefly from papers published in German medical journals which have reached this country during the war, but partly, also, from unpublished data forwarded to the Medical Research Council from the Army Medical Department and from other sources. As Secretary of the Council's War Wounds Committee, I recently prepared for that Committee a short review of German work on war wounds and injuries as indicated by papers abstracted in the *Bulletin of War Medicine* between September 1940 and February 1945, and as this review contained

## SECTION X

### Unclassified Subjects

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fractured femur in Germany during the war. The nail is three-flanged, so as not completely to block the marrow cavity, and is driven into the fractured shaft of the femur through the top of the greater trochanter. It is a form of treatment which may obviously be very dangerous in inexperienced hands, and a certain number of disasters following its use have in fact been seen in German prisoners of war.

Considerable publicity has been given in Germany to methods of locating metallic foreign bodies by a high-frequency apparatus, apparently similar to the American 'Moorhead locator,' and by a special radiographic appliance called the 'boloscope,' made by Philips of Eindhoven. Knowledge of the German metal locator first reached this country through a Nazi propaganda broadcast, and it is of interest to recall that on the basis of this broadcast, two of Professor S. Russ's assistants at the Middlesex Hospital were able to build a working model of the locator. Their conclusions about it seemed to tally with those reached by various German authors, namely that this particular appliance is of use only for detecting the presence of foreign bodies which are fairly superficially situated. The use of the 'boloscope,' of which details have been published in several German papers, seems a much more promising way of localizing foreign bodies.

One of the previous speakers mentioned a German trial of mepacrine and calcium gluconate for the treatment of typhus fever, papers on this treatment were published in Germany in 1942, and were abstracted in the *Bulletin of War Medicine*. The abstractor had commented, however, that the suggestion that mepacrine acted on the causal organism of typhus was not supported by the evidence quoted in these papers, and it appears that the treatment has since been abandoned as unsatisfactory.

All in all, the evidence presented in recent German publications supports the view expressed by other speakers at the Conference, that the average standard of German medicine and field surgery has shown a sad decline during the later months of the war, probably owing to an acute shortage of well-trained medical personnel.

# AXIS PRISONERS OF WAR IN A BRITISH HOSPITAL

COLONEL R. H. C. PRYN

*Officer Commanding a Prisoner-of War Hospital*

The hospital I have commanded since October last is a curious hybrid unit administered by the officer commanding the hospital, who deals with the medical side of the administration, and a camp commandant, an infantry officer who commands the guard and is responsible for the clothing pay security etc., of the prisoners. Certain subjects are very much border line and unless perfect co-operation obtains between these two officers, a delicate situation is created especially as the prisoners are quick to sense the position and play off one officer against the other. I am fortunate in having perfect co-operation from my opposite number.

No prisoners of war could be better housed. The hospital with its adequate equipment is a standard newly built E.M.S. hospital of 500 beds situated on high ground overlooking the Severn and in very beautiful country.

I had had some experience with smaller numbers of prisoners nursed in British general hospitals with very sketchy security precautions in the Middle East. I had never dealt with them in bulk before and I was surprised to find that they are permitted to use the Fascist salute when without headgear. As they are usually hatless, this is the normal salute one must expect, and no disrespect is intended by it.

Perhaps the characteristics of the prisoners and the means of dealing with them can best be illustrated by relating a series of incidents.

Shortly before Christmas I received a request from the German camp leader that lights out be at 12 midnight on Xmas Eve and Xmas Day and that midnight mass be held for the Italians. There had also been complaints that the hospital routine was too rigorous. I informed both camp leaders that I was unable to grant their requests, though I would give them an hour's extension, and that they were and would continue to be treated exactly according to the letter and spirit of the Geneva Convention. The surgeon next reported to me that a portrait of Hitler had been introduced into the Christmas decorations as a centrepiece. My first reaction was that it would be removed at once, but I was informed that certain instructions, a copy of which was not at that time in my possession forbade this. As these instructions are meant to apply to camps, and the conditions in a hospital with British orderlies constantly among the patients are very different from those in a camp I decided that the portrait must



air is cleared, repentance is abject and all is set for the next cycle. Such incidents as the following illustrate the type of thing. A patient reported at the linen change that he had a slight split in his pillowcase. The N.C.O. in charge of the ward considered that it was serviceable and could be used whereupon the frenzied patient seized his pillow and tore it to shreds scattering the feathers to the four winds of heaven.

In the tuberculosis ward great difficulty was encountered in lighting a stove. The orderly failed and two patients failed whereupon the others recently removed from the S.I. list, struggled from their beds, detached it from the flue and carried it into the grounds.

We have a detention block where malefactors are incarcerated. There is little beyond segregation and deprivation of cigarette rations which can be used as a deterrent for a bad case, but a simple hygienic regulation has been very successful. In Rules for Detention Barracks it is laid down that the hair must be kept short. On commitment to the detention block a somewhat severe haircut takes place and has a very sobering effect, as Italians are very hair-conscious and some even keep their locks in shape by a hair net on retiring.

These incidents will give an insight into the Italian character. They are very childish and must be treated as children. They react well to praise and cannot be controlled by any rigid code of discipline, they must sometimes be ridden with a loose rein and at other times be curbed.

*Types of cases* - Over half the beds in the medical division are occupied by tuberculous infections of the lung pleural and peritoneal cavity. A good number of chronic Flexner amoebic dysentery carriers are dealt with and an odd case of liver abscess is encountered.

The surgical division is mainly occupied in operating on Italian inguinal hernias which appear to be very prevalent, though I rather suspect that they save them up to be operated on by us.

The German cases are chiefly orthopaedic from the Luftwaffe and Army and immersion feet from the Navy and Merchant Navy.

*Visitors and inspecting officers* - A P.O.W. hospital is the most visited and inspected of any hospital. In addition to the usual visits of administration medical officers consultants, command district and area commanders and their staffs there are visits from representatives of the Protecting Power, Foreign Office, International Y.M.C.A. and of the Mixed Medical Commission which decides on cases for repatriation.

*Conclusion* - Though my remarks may have given the impression that the hospital is in a perpetual state of turmoil, this is not the case, and the general atmosphere is one of peace which has become still more marked since the introduction of sisters. Occupational therapy and gardening are also a help.

be removed to avoid incidents I sent for the German leader and told him that his action showed lack of co-operation, that the display of the picture was provocative and that I expected it to be removed on Twelfth Night; at the same time I reported my action to P W 1 and asked for covering authority. Twelfth Night came and as the letter failed to materialize I had to emulate Nelson at Copenhagen and give orders for the removal of the picture. There was a certain amount of immediate reaction which took the form of a small epidemic of operation refusals.

Shortly after this there was an incident in the German ward in which a very nasty young pup of a Nazi officer was involved, who was also the artist responsible for the picture. As he had only an hysterical paralysis following an organic one due to a lesion of the radial nerve, I fired him out of hospital. Harrowing protests to the Protecting Power followed from him, but produced no change, and authority was vindicated and consolidated.

The Germans are well disciplined and will give little trouble if one makes it clear that one will stand no nonsense. Also one must smell out and eliminate in some way or other gentlemen of this artist's type, who are arrant lars and do their mischief *sub rosa*, by stirring up others to do their dirty work.

About a week after my arrival an administration change necessitated four Italian tuberculous spinal cases being temporarily accommodated at the far end of a 36-bedded ward with 10 cases of pulmonary tuberculosis at the other. Shortly after the arrangement had been completed, I was informed that they were threatening to get out of bed unless moved. They were interviewed by the medical specialist and told there was no risk of infection, and appeared mollified. Some hours after this an S O S was sent out that one of them with a fairly fresh Albee's graft had risen from his plaster bed and refused to return thereto. He was persuaded to return by the orderly officer and fermented there for a day. Finally I was informed that all four had arisen and were holding an indignation meeting in the ward corridor. I have no time to relate how the situation was coped with without loss of prestige, but will merely point out that tuberculophobia is a very real thing with all Italians and must always be taken seriously into consideration. There is certainly some justification for their attitude as more than half the cases in the medical division are either pulmonary tuberculosis, or tuberculous pleural and peritoneal effusions. Twenty-two cases of pulmonary tuberculosis were recently repatriated to Italy and quite a few of them were loth to go as they stated they were looked on as lepers in their own land.

Italians are temperamental souls and it appears that at intervals some have to have what we term a 'mental menstruation,' a minor discharge of inco-ordinated mental energy occurs, after which the

colloidal emulsions for intra arterial injection in the treatment of meningitis. Professors Louria Friedland and others have produced sera which they call cytotoxic, which are said to stimulate reticulocytes with beneficial effects in diminishing the healing time of ulcers (including peptic ulcers) fractures and wounds generally. They also employ activators derived from placenta or from partially ischemic skin, for the same purpose.

Professors Anokhin, Shabadash and Kusinof are developing methods for the preservation of nerve transplants, and are studying the regeneration of damaged divided and grafted nerves and in afferent nerves the action currents accompanying impulses from painful stimuli.

Professor Bagdasarov, head of the Institute for the Study of Blood Diseases is employing goats blood as a stimulant of repair whilst Professor Spassokukotaky is treating shock by repeated doses of 2.5 to 10 c.c. of incompatible blood.

It should be stated that the majority of research laboratories from Leningrad and Moscow had been transported to the East for safety and that in consequence only a fraction of the work in active progress came under our personal observation.

NOVEMBER 1943

## NIGHT VISION TRAINING AND NIGHT VISION IN OPERATIONAL FLYING

WING COMMANDER J. C. MACGOWAN D.F.C., R.A.F.V.R.

The investigation of night vision in the R.A.F. was started several years before this war by Air Commodore P. C. Livingstone, O.B.E., A.F.C., and it is due to his efforts that so much attention is now paid to the selection and training of our night flying crews. My main interest has been in the night vision training of flying crews in Bomber Command.

In a heavy night bomber the people most concerned with seeing in the dark are (1) The gunners, and (2) the visual bomb aimer.

It is the gunners' job to protect their machine from attack by enemy night fighters. If a gunner in a bomber can spot the night fighter first, that bomber need never be shot down, as by taking evasive action the pilot can always escape his pursuer in the dark. The visual bomb aimer has to identify his aiming point under conditions of poor visibility and direct his pilot to it. He must also be able to identify landmarks on the route to the target. The master bomber may have to direct a whole raid by wireless and on him the success, or otherwise, of the attack depends.

OCTOBER 1943

## MEDICAL MISSION TO MOSCOW

SIR ERNEST ROCK CARLING, F R.C.S., F R.C.P., F F.R.

*Consultant in Surgery to Emergency Medical Service Consultant for Casualty Services,  
Ministries of Health and Home Security*

The Mission of which I had the honour to be a member, included representatives of the Office of Scientific Research and Development, the National Research Council of Canada, and the Medical Research Council. They made contact with the Soviet National Research Council and learned that problems presented by the high command of the armed forces were distributed for solution amongst the medical schools and institutes in accordance with the particular experience of professors and their teams. Four problems were stated by the People's Commissar of Health as in the forefront of their immediate activities: shock, gastric ulceration, neurosis, and 'camp fever' which presumably is 'typhus'.

Two physiologists, both academicians, Orbeli and Lena Stern, told us of their work. The former was relating his studies of the Purkinje effect in relation to dark-adaptation for pilots and continuing his research on the connection of the autonomic system with the cerebellum. Lena Stern, studying shock, believes that the dynamic disturbance of the circulatory system is ultimately a function of centres of the autonomic system situated in the walls of the ventricles. She advocates forcible injection of calcium phosphate into the cisterna magna. She recognizes three stages in shock: first excitement, then torpidity, then paralysis. In the first two, transfusion of fluids may succeed, in the third, only vigorous stimulation of the centres will restore response. Professor Stern said that she had had numerous protocols of cases from front-line surgeons demonstrating success for her method when hope had been abandoned.

Professor Grashenko is making detailed studies of the bacteriology of gas gangrene especially in the central nervous system, and besides the organisms usually found has observed special clinical symptoms associated with a *Clostridium fallax*. He told us that he was accustomed to treat the infection by twelve daily doses of streptocide intrathecally, besides intravenous administration of the same drug and of serum. He said he had bacteriophages for all organisms.

Professor Lossovsky uses an ultrasonic generator for the production of microcrystals of sulphonamides. With them, by the aid of chemical stabilizers he produces colloidal emulsions in which oil is gradually reduced until they are almost wholly aqueous. He also produces emulsions of sulphadiazine in camphor which are valuable in the treatment of bedsores. Professor Paramanof has been using the

presently a red ball appears not far from where the tracer was. The ball of flame increases in size and starts falling towards the earth with ever increasing velocity. It leaves behind a trail of flaming fragments till it ends up a glowing mass on the ground. This was a machine whose gunners had not seen the approach of a night fighter.

Nearing the target the bomb aimer tries to pick up landmarks on the ground which he has memorized. There is no time to look at a map in the target area. He may be helped by flares dropped by aircraft ahead of him, or by the light from searchlights or fires on the ground. A good pair of night binoculars is very useful at this stage. Having picked up his surroundings he directs the pilot towards the aiming point allowing nothing to interfere with his bombing run. The target area itself is an inferno with the air full of flak burst and the ground covered with fires, exploding bombs and gun flashes. This lights up the whole of the sky and the gunners again must remember not to watch the conflagration but keep an eye on the dark sky outside.

On the way back the fighters are out in packs. They sometimes drop flares above the stream of bombers to light them up and attract other fighters.

We hear our rear gunner calling up our captain. 'Fighter approaching from port quarter. Get ready to dive to port, steady, Down, and down the machine goes in a dive and the fighter unable to get in a burst overshoots us and is lost in the night. This may happen several times on the way back and shows the necessity of good night vision on the part of our gunners.



Preliminary night vision training consists of explaining and teaching the rules of dark adaptation and parafoveal vision. The next step is the practice in the dark of the particular task to be performed. Experience and foreknowledge are of the greatest importance in working in the dark, as vision depends not only on perception but on the added factors of experience and the psychological interpretation of that experience. In addition the higher faculties of attention and interest play a large part in ability to see at night.

Gunners are given exercises under conditions simulating moonlight, half-moon and starlight. These exercises consist of scanning, spotting, recognition and use of the reflector sight on moving silhouettes.

Bomb aimers are taught how to examine mosaic photographs and pick out in them the landmarks which are going to be visible at night and help them to identify their aiming point. These landmarks must be memorized and orientated in the mind of the bomb aimer, so that if only one is visible he knows the position of the others.

An account of a night raid over Germany might be the best way to give an indication of what is required in the way of night vision on operations.

A bus takes the crews out to the aircraft. It would not be true to say that they are not nervous, although they laugh and joke about the coming trip in a nonchalant sort of way, everyone knows what everyone else is feeling inside. Once in the machine, however, all apprehension is gone and each member of the crew settles down to his particular task. On the journey out before reaching enemy territory, the gunners try their guns and rotate their turrets watching out to see that we do not collide with any of our own machines. As we approach the enemy coast the searchlights flick on, long spidery fingers searching the darkness of the sky till they pounce upon some unfortunate victim. Once caught in the apex of a cone of searchlights, a machine has no chance of getting out of it until it has flown beyond their range. The apex is filled with bursting ack-ack shells and every night fighter in the vicinity rushes in to get a shot at the wretched bomber which can be seen from miles away. The pilot of the coned machine must on no account look out. If he does he will be glared by the intense light. He must keep his head down in the cockpit and concentrate on flying by instruments. The gunners should only look up and avoid looking down at the searchlights and losing their dark adaptation. They sometimes shut or cover one eye in an effort to maintain dark adaptation in that eye. It is fascinating to watch a machine in a cone but gunners must remember that they will be silhouetted against its light background and they must watch out on the other side, for that is where the night fighter will make his attack. He always attacks from the darkest into the lightest part of the sky.

Having got through the belt of coastal searchlights we proceed on our way to the target. We see a short burst of tracer bullets in the sky,

## SECTION XI

# Medical Organization for and Operations on D-Day and Immediately Subsequently

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## A - PREPARATIONS FOR D-DAY

BRIGADIER Q. V. B. WALLACE, C.B.E., M.C.

*D.D.M.S. 1 Corps, B.L.A.*

I hope to put before you the outline and a few of the problems that face us in forthcoming operations in Europe, with regard to the evacuation of casualties.

I would, at the start of my talk, ask you to put out of your minds previous operations in Sicily, Salerno and the Mediterranean, for the following reasons -

	<i>Mediterranean</i>	<i>Channel</i>
(i) Weather	Fine and warm. Blue skies - warm water	Unsettled weather Grey skies - cold water - rough seas.
(ii) Tides	None	25-27 ft.

Germany has, in four and a half years, at least had time to place a few strands of barbed wire along the coast, and it is certain that they will have used all their ingenuity in defending this coast. Presumably the defences will be manned by Germans with a definite order from Hitler to hold to the last man, and to throw the enemy into the sea. It will therefore be seen that the evacuation of casualties from a bridgehead in Western Europe presents problems which differ greatly from any yet undertaken.

It has been necessary to reduce the number of medical units landing to a minimum, and to land these units at a reduced scale, which we call an assault scale, and everything that can possibly be done without must be left behind.

The aim of the Army Medical Services is skilled first aid for all, and life-saving surgery for those who require it and cannot be evacuated to the United Kingdom at once.

It must be recognized that this operation will be a hard one for the wounded, and that this is forced upon us, not from choice, but that it must be accepted as an operational necessity.

Now what medical units have we available to look after the wounded in a landing on the enemy's shores? Let us take it on a basis of one assault division landing on a foreign shore. The division itself has three field ambulances, and these are used by placing one section of a field ambulance with each assault battalion - i.e. one officer and eighteen other ranks, R.A.M.C. The remainder of the three field ambulances can provide three advanced dressing stations - one for each brigade.

In addition to the three field ambulances of the assault division we have landing with an assault division a beach sub area, which consists of two beach groups, and in each beach group we have two field



medical personnel, and whole blood will also be available with field transfusion units. 'Giving sets' are being landed in large numbers by all units - one set for every two bottles. Medical comforts, provision of ambulance cars, stretchers and blankets, seasick remedies, hot water bottles, Jeeps fitted to carry 3 stretchers, medical supplies, documentation of casualties, mine clearance, waterproofing of all vehicles, etc. all these, and many other problems, add to the worries of a D D M.S., not to mention the worries of an A.D M.S. of an assault division.

Casualties occurring at sea are a naval responsibility. This slogan is used regularly but casualties from landing craft are sure to find their way ashore, and then, of course, they become a military responsibility.

There are, of course, many other problems that I have not touched on - hygiene of the beaches, the care of prisoners of war, and the civil population, which, although not an Army responsibility being a matter for civil affairs, I feel in the early stages will be our baby.

## B - THE FAR-SHORE

OCTOBER 1944

### MEDICAL PLANS FOR THE INVASION

COLONEL DAVID E. LISTON M.C., U.S. ARMY

*Deputy Chief Surgeon, European Theater of Operations*

In a recent article covering beach head operations during the initial phase of the invasion of France, W B Courtney stated Battle has many phases. Confusion is chief of these. If you think of invasion as a massed, steady controlled forward movement of great ranks you are wrong. Landing parties quickly break down into numerous little bands of men squirming through obstacles, darting in all directions, getting lost - isolated, killing or being killed. Looking beyond the immediate scene, however, one recognizes progress according to a common plan. To ensure that this pattern of battle survives, in spite of the inability to maintain mutual contact of other than small groups, both good training and planning forethought are required.

The medical plan must ensure that. (1) The element of the sick and wounded that gives evidence of early fitness for battle moves no farther to the rear than requirements for medical care dictate. (2) Patients with little salvage value are evacuated to fixed installation in the rear with the least possible delay. (3) That hospitalization and evacuation interfere to a minimum with movement of troops and supplies.

Conditions incident to the invasion of France, across a channel not

dressing stations with field surgical units, field transfusion units, and extra surgical teams attached. In addition, we propose to use the light sections of the field dressing station as beach dressing stations (giving us four for the divisional front), and finally, in addition, we have a unit called a casualty evacuation point which will be near the beach, and from which evacuation of casualties to craft will take place.

Now comes the greatest headache of the whole evacuation, i.e. evacuation from shore over beaches and water gap to United Kingdom. Hospital ships are out of the question in the early stages. Hospital carriers are very slow to load, vulnerable of course, and carry only a limited number of wounded.

The only available craft to evacuate casualties in large numbers are L S T s (landing ships, tank), converted to carry casualties on the return trip to United Kingdom, having arrived loaded with vehicles and tanks. An L S T can carry 150 to 200 stretcher cases, and some hundreds of walking cases.

Now in view of the fact that the medical units on shore on D-day are all 'evacuating units,' and are not designed to hold cases in large numbers, the success of the whole evacuation of casualties must depend on 100% evacuation of those capable of being evacuated by sea. This can only be done by the requisite numbers of L S T.s and hospital carriers being available at all tides when and where they are required by the senior administrative medical officer on shore. Casualties who have been operated upon must be kept six to ten days, and will use up all the holding space available in medical units ashore (only stretchers and blankets in whatever shelter - tents, etc., can be made available).

If craft are not available at the right time, either owing to operational reasons, or bad weather, then all evacuation will come to a standstill, and this means that the assault division would get its field ambulances overcrowded and that the field dressing stations on the beach would also be crowded, and there would be a general damming-up of the stream of evacuation throughout, with lack of cover for wounded.

From the casualty evacuation points, and from the beach dressing stations, casualties are evacuated by DUKWs<sup>1</sup> to L S T s at sea, and by water ambulances to hospital carrier.

A DUKW can carry eight stretcher cases, and a variable number of walking cases, varying with weather conditions.

C C S s are planned to land, and be in operation, by the morning of D+1, and these will be the only units capable of providing anything in the nature of comfort for patients. This will be crude to begin with - only stretchers and blankets.

There are dozens of points that we think are being dealt with successfully. Amongst these -

Field surgical units and field transfusion units are being landed with field dressing station on D-day. Wet plasma is being carried by all

<sup>1</sup> An amphibian carrier

naval medical officers and 22 hospital corpsmen. During the first three trips, this personnel was augmented by one competent operating surgeon (Army) and two Army surgical technicians. This system of water evacuation was augmented shortly after D-day by hospital carriers, supplied by the British Navy.

Water craft were met on the near-shore by ambulances which transported those not capable of standing a 15 to 20 miles ambulance trip to holding units normally within three miles of the Hards. All others were taken to transit hospitals some distance to the rear by ambulance where they were further prepared for movement or given necessary treatment. Evacuation to the rear of the transit hospitals was by hospital train to general hospitals for definitive treatment. Patients whose period of hospitalization would indicate that they be returned to the United States for continued therapy were to be evacuated from the United Kingdom either by air or water. Resupply was by means of balanced units of medical supplies carried by L.S.T.s and furnished on an automatic basis. Emergencies were met through air lift.

*Phase 2* - This phase anticipated increased depth to the beach-head and a lapse of time sufficient to allow us to bring other mobile medical units across from the far shore. Platoons of field hospitals are now seen in relation to the clearing stations of the divisions. These constituted a further haven for non-transportables that might have immobilized medical divisional units. Evacuation hospitals are interposed between divisional medical units and the beach clearing station to further allow for retaining and treating individuals showing promise of early return to duty and accommodating and treating such non transportables as arrive at these semi mobile installations. Some air lift is also anticipated at this time and air holding units have been developed. As the result of air lift from the far-shore air holding and air transit hospitals are seen coming into the picture in the United Kingdom.

*Phase 3* - Phase 3 was predicated upon the acquisition of port facilities on the far-shore through which the heavier fixed hospitals of the medical service could be unloaded and the existence of a zone of service responsibility in rear of the field armies. Air lift was now not only from the army area but also from and into the area of responsibility of service troops. With such adequate hospitalization on the far shore and no reason for patients being returned to the near-shore in such condition as not to stand further travel, the holding units in the U.K. have been eliminated and all patients arriving by sea are evacuated directly to transit hospitals by ambulance.

*Phase 4* - This offers little change from the previous phase except that we now have the assistance of more extensive intra-continental air lift and evacuation of patients by water from the Continent directly to the U.S. in selected cases. Air lift directly from the Continent to the United States gradually becomes a reality.



always friendly to travel and in the face of well-prepared defenses, indicated two additional requirements. First, the plan must make provision for the return to the near-shore during the initial phase, of even that fraction of the wounded normally considered as 'non-transportable' and, second, insure a build-up of medical facilities on the far-shore as soon as conditions permit

The final medical plan evolved embraced a gradual and progressive transition from a far-shore medical service rendering merely medical aid, to one of great complexity. This transition will be considered to have consisted of four phases.

*Phase 1* - This phase furnishes us the basic pattern of medical care and evacuation during the entire operation. No modifications were made in the organization or equipment of the normal medical service with assault or subsequent divisions except for the amphibious packing of supplies. Company aid men, maintaining contact with their respective companies, rendered such medical aid as was possible, battalion medical sections, following closely upon the heels of battalions established close in their rear. Such wounded as they could immediately patch up and return to battle, were so handled. Others were prepared for collection by litter bearers from the medical battalions of divisions. Each unit returned the maximum number of sick and wounded to battle and evacuated others to the division clearing station where sorting was again effected and patients returned to units or prepared for rearward movement. Maintenance of mobility in these units was most essential. The percentage of patients held in mobile units was to be maintained at a minimum.

The requirements for a far-shore 'holding unit' for the non-transportables was eventually to be met by the beach clearing station of the medical battalion of the engineer special brigade, responsible for the organization of a particular beach. The beach clearing station of this unit acted not only as a 'holding unit' but evacuated patients from the clearing stations of the advancing divisions and formed a link between the division medical service and the Navy beach master who was to be responsible for the water lift of patients to the near-shore.

It was determined that water lift from France to England would be by means of 'landing ships, tank,' a standard U.S. Navy vessel, especially modified for the carrying of casualties. These craft, having performed their primary mission as conveyors of tanks and other self-propelled vehicles to the far-shore, were, wherever possible, to stand off-shore and await reception of patients. It was planned to have all L.S.T.s medically manned provided the personnel for this purpose could be made available. This would materially lighten the Navy beach master's task, insuring medical care to personnel organic to these ships and keep the number of helpless cases on any one L.S.T. low in case of necessity for abandonment. During the actual invasion and until no longer needed each ship was medically manned by two

At the time of landing most of the planned hospital sites were untenable either because of heavy mining or the presence of small groups of enemy snipers in hedgerows bordering the selected fields. Vehicles with equipment were located with some difficulty particularly on Omaha Beach, because of enemy resistance.

Under such conditions early work performed by medical battalions and attached surgical teams was limited to first aid in fox holes, tank traps, and pill-boxes. Dressings were performed morphine administered and some plasma given to critical cases. Beyond this all efforts were devoted to evacuation using any outgoing craft available. When conditions improved, vehicles and equipment were located, hospital sites were selected, the areas checked for mines and setting up of the tents begun.

In the absence of medical battalion clearing station equipment in the earlier phases, some attempt was made to perform surgery in divisional clearing stations but was quickly discontinued because of inadequate supplies. The first surgery on Utah Beach was performed at H+12 and on Omaha Beach at H+36.

Once set up, no difficulties were encountered in performing the required surgery except that the volume of shock and first aid therapy necessary limited the amount of surgery that could be done. The time and care expended in preparation for the task completely justified itself for there were no deficiencies in instruments or material necessary to perform the most major type of traumatic surgery. Whole blood was available on D+1 and was of incalculable value.

Each surgical team during its four to six day period of attachment to the medical battalion clearing station performed an average of six major operations a day. The greatest time was consumed in resplinting dressing preparation for evacuation and particularly in shock therapy. A total of 1,150 cases passed through the 634th Clearing Station of the 60th Medical Battalion on Omaha Beach in five days. Of these, 125 received surgery in the clearing station.

A breakdown of cases operated on by all teams of the 3rd Auxiliary Surgical Group reporting shows the following types of wounds:

Abdominal	15/
Chest	10/
Thoraco-abdominal	25/
Major extremity injuries	475/
Miscellaneous	25/

Although maximum exploitation of available air lift was always contemplated by the plan it must be emphasized that at no time was any air lift for casualties guaranteed. The Supreme Commander reiterated on several occasions that any air lift that we might receive was to be considered in the light of a bonus and that plans for evacuation must at all times ensure sufficient means other than air to meet the total evacuation load. Nevertheless, by August 12, some two months after D-day, air lift had more than equalled lift by water and from that time on played a prominent part in casualty evacuation.

In the light of subsequent operations we can say that the plan for medical evacuation as developed prior to the assault was fundamentally sound. Admittedly it had minor weaknesses. These, however, never became manifest due to excellent air assistance.

As a result of adequate planning and with fortune smiling upon us the fighting man rarely wanted for adequate medical care.

OCTOBER 1944

## SURGICAL EXPERIENCES D-DAY TO D+7

MAJOR BENJAMIN R. REITER, M C, U S ARMY

In preparation for the care of the seriously wounded soldiers, surgical teams of the 3rd Auxiliary Surgical Group were assigned to the clearing stations of three engineer special brigades two months previous to D-day. The plan was for the 16 teams to function in the Medical Battalion Clearing Stations which for this amphibious manoeuvre were to be specially equipped for the performance of major surgery on the more seriously wounded soldiers. In other words, these clearing stations were to be temporarily converted into modified field hospitals.

The preparation period was spent in obtaining and preparing material needed, complete reorganization of the clearing station equipment, coordinating conferences with naval beach evacuation officers, and in amphibious manoeuvres.

On Utah Beach landing of medical personnel was on schedule, but on Omaha Beach the main clearing station and surgical team personnel was three to twenty-four hours behind schedule. All beaches were under artillery and sniper fire at the planned time of landing but in addition many of the Omaha beaches were under mortar and machine gun fire and some were still in the hands of the enemy, necessitating delay and subsequent use of alternate beaches. A strong wind and current parallel to shore made beaching of Rhino barges difficult, and in some cases personnel was transferred to L C V P's for landing.

from the ship's sick bay, and gauze, gloves, towels, etc., were placed in large biscuit tins and sterilized in the ship's steam pressure ovens. Eventually after two or three days of steady work, we felt we had done everything possible in the way of preparation.

As yet we had not loaded with troops or equipment. However, there was little delay and on the afternoon of June 5 we moved off - a fine, though fairly windy afternoon. It was a magnificent sight - hundreds of ships of all descriptions, loaded from bow to stern with the finest mechanical equipment for the finest mechanized army. There we were, an American ship with an American crew, loaded with British tanks, manned by British Tommies and carrying a contingent of the Canadian Medical Corps. Allied nations, really at work. We Canadians on board that ship shall not forget those English soldiers. Happy confident, they just knew they would win. They had the tools to do the job.

We arrived off Normandy, late in the evening of D-day. The tenseness which we felt as we approached the shore quickly gave way to excitement, on seeing so many ships in so small a space.

As darkness came so came the first enemy planes. We could barely see them at first. Unfortunately three L.S.T.s including our own opened fire and down came the planes after us. One bomb landed within 20 yards of our stern and the ship was tossed like a chip but there were no casualties.

Though the raids were light and spasmodic, we did not go to bed that night. The next morning we were to unload on to large Rhino ferries. However the wind blew with increasing fury so unloading by such a method was impossible. We lay off shore all day and through the heavier bomber raid of the second night.

Early the next morning on D+2 there was still quite a gale so we grounded our ship on the beach head at Courpelles.

After the ship had unloaded, there seemed to be no sign of casualties. We therefore went ashore to investigate. To those of us who had never witnessed the horrors of war the sights were appalling. The sub-beach head, where we landed, had been taken by the Winnipeg Rifles of Canada. Now - two days after the invasion - the bodies of Canadians and Germans still lay where they fell, packs on their backs and partly covered with sand. Pill boxes were strewn with German dead and the food of their last breakfast was still sitting upon the table. The sand of the beach was littered with the remnants of battered tanks and small landing craft.

After wandering about for a considerable time and distance, we located a casualty evacuation post in a roofless schoolhouse. There were over 100 casualties here of which the medical officer was glad to have us relieve him. At the moment there was no means of transportation, so two of us went back to persuade the captain to hold the ship. However he was subject to the orders of the beach master and



all night preparing food for the casualties. Soups, bovril malted milk, light meals and hearty meals were available to the individual patients on request - all night long. In the serving of food our orderlies were joined by the ship's company and it was not unusual to see hardened American sailors, many of whom had been on the guns most of the previous two nights, spoon feeding wounded Canadian and English soldiers.

On very few cases was it necessary or advisable to do surgery aboard ship and so very little was done. However with making the rounds, seeing, examining, reassuring the patients, splinting their extremities, giving infusions and dressing wounds, the evening and night quickly passed.

Then came the dawn and with it a nightmare of documentation. Oh, how many times did I profanely abuse the Army on that tired morning. Yet in my most sombre moments I realized the importance of these forms. There were cards in triplicate with name, number, age, unit, diagnosis and signature for each patient. Field service cards on many had been lost in transit, so new ones had to be started and brought up to date, with all details of treatment and medications. There were yellow penicillin cards to be tied to each patient receiving the drug and filled in with the dosage, date and hour of administration. There were yellow bands to be tied on the arms of seriously ill patients, who were then segregated for priority disembarkation.

Finally there were reports in duplicate and reports in triplicate, for the authorities at the dock, designating severity of the injury, nationality, status as to rank, and so on. We eventually finished and docked shortly after noon, none of us having had any sleep since before our first night in France. Our fatigue was perhaps lost in the background when we mentally reviewed the results of our work. None of our patients had died, all were now conscious, none was in great pain, and the majority were smiling and happy. There was a sense of satisfaction in our minds, in feeling that we had done our job at least reasonably well.

So ended a trip, typical of the experiences of those in similar ships. We did see other ships being loaded in the prescribed manner by the use of DUKWs but many were loaded while grounded on the beach by any vehicle available. We did not have that experience. In all we made three trips over a period of two weeks, before finally returning to our hospital in England.

we backed off the beach, soon after our arrival, minus one medical officer and without casualties

We anchored a mile off-shore, awaiting the formation of a convoy, feeling very blue indeed

We had not waited long before a change of fortune occurred, and the fulfilment of our mission was realized. Shortly after lunch an anxious and worried-looking English medical officer came alongside saying that he had in error, loaded 128 casualties aboard another L S T which was not equipped with medical facilities nor medical officers, and requested a loan of medical personnel

We felt, after all our preparations, that little adequate care could be given unless casualties were aboard our own well-equipped ship. Consequently we spoke to the captain about getting them transferred. By this time the sea was very rough indeed. Nevertheless, the captain with his flare for excitement and the unusual, weighed anchor, turned his ship around, and in a most beautiful manoeuvre, brought her smoothly alongside the other L S T. Both ships were quickly lashed together, gang planks were thrown across the junction and with the full help of both crews, 128 stretcher patients were transferred from the tank deck of one ship to the tank deck of the other, in less than twenty-five minutes. We finished just in time to catch the tail end of a convoy, and were on our way to England

Then came the work. The casualties had all occurred in the initial beach assault, or shortly after, and were now over forty-eight hours old. All wounds were covered with a shell dressing, but none had received any tetanus antitoxin, sulfonamides, penicillin or any other form of medication, except morphine. Most had lain in a field, on a stretcher, and in the clothes in which they were wounded. The sand from the beaches was still inside their boots and clothing.

We transferred the seriously ill patients to the aft end of the deck near the supplies and operating room. To all patients we gave sulfonamides, and tetanus antitoxin. At least one-half received morphine hypodermically in  $\frac{1}{2}$  grain doses, on one or more occasions. Patients with severe extremity wounds, whether a fracture was present or not, were splinted. To compound fractures and gaping muscle wounds we gave penicillin in 50,000 or 100,000 unit doses. Shocked patients were given blood, serum, or both, in generous quantities, depending on cause and severity. It was a dramatic sight to look along the huge deck and see the numerous infusion bottles dangling from ropes and swaying in all directions as the ship pitched and rolled.

In our casualty list there were 30 German prisoners. These received the same attention and treatment as our own, except for penicillin.

In addition to medical requirements these patients were hungry, and it is in this regard that praise should be directed to our American cooks. After working well into the nights of the previous week to generously feed the 300 or so additional British troops, they stayed up

wounded and could accommodate upwards of 150 cases. A small dressing-station was rigged with canvas over a light tubular frame work of approximately  $18 \times 8 \times 8$  at the after end of the tank deck, and on the after bulkhead which formed the after wall of the dressing-station, were fitted additional lighting heating and hot and cold water with drainage. A meeting of consultants of the three Services had agreed upon the scale of instruments and drugs to be supplied. Adequate replenishments had been ordered which included whole blood and were available at the Harbours, the disembarkation points, at Home Ports. So much for the preparations - now for the operation. It was not considered feasible for L.S.T. to beach far less to dry out, and so we had to be prepared to do all the loading from craft and DUKW and some training had been instituted in these manoeuvres but fortunately the L.S.T. dried out without damage and our loading difficulties were vastly simplified. A naval medical liaison officer was appointed to each beach to assist the smooth working of the evacuation, and by D+6 the D.D.M.S. Second Army decided to canalize all evacuation through the centre beach head JUNO. This simplified matters still further for to ensure that three medically manned L.S.T.s were available at each tide on all three beaches, was almost impossible to guarantee, and at times it proved difficult enough on Juno beach but the C.E.P. (casualty evacuation point) was now well under way and had a holding capacity of upwards of 1 000 beds. There was another important line of evacuation namely by hospital carrier. These were, of course, infinitely better than the rapidly converted L.S.T. but their capacities varied from 200 to 400 and there was no quay or wharf alongside which they could lie and load. This, however was done by their own hospital boats of which they carried six, and when the state of the tide permitted, these boats were all sent into the little harbour at Courseilles, where they loaded up from an ambulance convoy from the C.E.P.

A word about these craft. These were modified L.C.P. (S) (landing craft personnel (small)) a craft designed to be hoisted at ordinary ship's davits, 28 ft. long by 8 ft. 6 in. beam weighing  $2\frac{1}{2}$  long tons, of shallow draft, 6 in. forward and 1 ft. 9 in. aft, and powered by a Chrysler Crown 30 h.p. engine. We modified them to carry six stretcher cases and with a crew of three merchant seamen one R.A.M.C. orderly and ten walking wounded they were capable of being hoisted to deck level fully loaded. Whenever the weather was reasonable they were admirable, but they bumped robustly in a moderate swell and thumped in their falls while being hoisted out of the sea. DUKWs were used to load hospital carriers but again the stretcher cases had to be man hauled to a sally-port which was a hazardous process if any sort of sea was running. L.C.T. (landing craft, tank) - craft of anything from 108 ft. to 191 ft. in length with an open deck, were used, but this loading method necessitated individual slinging of cot



## EVACUATION OF CASUALTIES BY SEA

SURGEON CAPTAIN W B D MILLER, D S C, R.N

*Fleet Medical Officer, Allied Naval Commander-in-Chief Expeditionary Force*

For such a vast operation the naval medical commitment fell roughly into two categories, one relatively static, i.e. lying off the enemy beaches, and the other mobile. In the first category came all the bombarding ships, the protecting destroyers, the depot ships, and the minesweeping flotillas, which moved in the area. In the second came the personnel ships and the L S T (landing ship, tank), which were constantly in transit across the Channel.

It was an extraordinary sight to see hundreds of ships of all sizes anchored off the enemy coast, spread out as if for some mammoth review. On the British front the assault had been made on three beaches, designated from east to west as 'SWORD,' 'JUNO,' and 'GOLD.' The ships and landing craft had been subjected to shelling, there were constant incidents through striking mines, and the ordinary risks of weather which at this time had not been uniformly favourable. Casualties which had occurred among the off-shore ships were either ferried in-shore to join the main casualty evacuation stream, or taken direct to a hospital fitted L S T, which was shortly leaving the area. The depot ships had accommodation for upwards of fifty cot cases apiece, but the earliest possible evacuation was obviously desirable. Unfortunately the shipping casualties were rather heavy at this stage, and hospital-fitted trawlers were sent to the areas to do the collecting of casualties, as these craft can work in almost any weather. The off-shore commitment operated by itself and though several times extended, was never oppressed.

Interest was certainly focused in the second category, for here lay the instrument on which the bulk of the sea-borne evacuation depended. This had always been the big problem in amphibious warfare, and much careful planning had been carried out by all three branches of the Services among the Americans and ourselves. We had met together, we had experimented, and we had devised from one common pool of knowledge. For the British Sector seventy L S T's had been fitted for casualty evacuation, forty being medically manned by the R.N. and thirty by the R.A.M.C. Briefly, the modifications consisted of adjustable racks to carry three-tier stretchers on either side of the tank deck, accommodating 144 stretchers. Experience with L S T at Anzio had demonstrated that stretchers laid on the tank deck were quite acceptable for a relatively short journey and when suitably arranged gave ready access for nursing attention. The troop spaces were difficult of access but were suitable for walking

no care, other than first aid was given on the far-shore, whereas later on primary surgical therapy was given on the far-shore in field and evacuation hospitals before evacuation to the near-shore. In the early days some seriously damaged casualties reached the near-shore for whom further movement would be dangerous. It was this contingency that made us plan holding hospitals for critically ill patients both at the disembarkation ports and air strips.

For these holding hospitals we used field hospitals (A field hospital is a small unit, using tents and capable of maintaining 400 beds, also capable of division into three platoons serving a hundred beds in each platoon.) To ensure adequate professional care expert surgical teams were assigned to such hospitals in number according to the load being carried at any specific point. Moreover, such teams could be and were shifted from time to time as pressure developed or personnel broke down under the physical strain. These holding hospitals (similar to the British port hospitals) were only used for the care of the seriously injured or non-transportable cases. This included abdomens, chests and maxillo-facial wounded if they arrived without definitive surgery and some multiple fractures remaining in shock after therapy on over seas ship transports (L.S.T.s and hospital carriers).

Those casualties considered transportable - all casualties were supposedly properly tagged on ships and re-evaluated during unloading on the near-shore - were taken by ambulance to hospitals (either Station or General) within a 25-mile radius of the disembarkation point. These hospitals were designated transit hospitals and their function was to evaluate the casualties re-dress all cases, treat for shock and carry out primary surgical therapy where it seemed essential for proper care. If pressure was great (and at the height of the early days one such transit hospital had over a thousand admissions in twenty hours) such hospitals did little definitive work.

From such transit hospitals evacuation was by train to general hospitals. A full train carried about 300 cases, and such a load was great for a single general hospital, but for a hospital center where wider distribution was possible, the load could be more evenly distributed and therefore the individual casualty received more immediate care. To fill in weak spots or bolster up hospitals receiving large loads, we again made free use of surgical teams. These came either from our auxiliary surgical group or from teams made up from hospitals not in the reception area.

A full appreciation of the system includes the professional care of patients on L.S.T.s. Because of the fear that in the early days everyone might be shovelled on to L.S.T.s and not held on the far-shore if critically ill (largely abdomens and chests) a competent surgeon, in addition to two naval junior medical officers, was placed on each L.S.T. and each hospital carrier and a small operating room was installed and equipped on each L.S.T. These surgeons proved useful

cases, and was a lengthy process. By a suitable variety of methods hospital carriers were loaded, and once aboard the conditions were very favourable. Furthermore, the carrier went along. Southampton, was met by a hospital train, and little delay was experienced in getting away to the general hospital. By this time the air was beginning to take a share of the load, and Dakota's leaving the air-strip at Banville regularly. Each aircraft carried eighteen stretcher and six walking cases.

*Impressions.* — Efficient communications are as important in medical service as in any other branch. The intimate and close liaison with colleagues of the other Services greatly facilitated Service working and enabled the problems of each sphere to be coordinated. We found, as indeed we anticipated, that we were very dependent on weather. Working by night was impracticable, the beaches had soft patches and holes in unexpected places, and could only be illuminated by faint blue lights when the ramp was down and the bow doors open. Moving about with our 'flak' rattle down was unpleasant. Our task has been greatly facilitated by the intimate integration of all Services from the early planning stage onwards, and, on the transport side, by three modern developments: the DUKW, the Dakota, and the landing ship, tank.

## C. — THE NEAR-SHORE

OCTOBER 1944

### PLANS FOR THE RECEPTION, CARE AND DISPOSITION OF CASUALTIES

BRIGADIER GENERAL E. C. CUTLER, U.S. ARMY

*Chief Consultant in Surgery, European Theater of Operations, U.S. Army*

The near-shore care which is my assignment can in no way hold the interest of the risk and excitement of those who went to the far-shore on D-day. But the war is not over and until it is every scrap of information leading to better care of the battle casualty is a major concern of us.

Evacuation to the near-shore began D-day by way of the utilization of LSTs (landing ship, tank) and hospital carriers, and D+5 by air, using troop carrier aircraft (C47 — a typical Douglas two-engine passenger plane, converted to hold eighteen litters in three tiers).

The plans for the reception of these casualties changed with the build-up of hospital facilities on the far-shore. Thus in the early

OCTOBER 1944

## ARRANGEMENTS IN SOUTHERN COMMAND FOR THE RECEPTION AND GROUPING OF CASUALTIES

BRIGADIER CHARLES DONALD O.B.E.

*Consulting Surgeon, Southern Command*

All British casualties, save a few unorganized ones received by the Eastern and South-Eastern Commands, were returned by sea and air into the military area of Southern Command. Those who came by sea were almost in their entirety, delivered at Southampton and Portsmouth. Those who arrived by air were delivered, again almost in their entirety at one of several aerodromes in the vicinity of Swindon.

The responsibilities of the Army were (a) In sea evacuation, to receive casualties at high water mark from the Navy to sort them as to their fitness for further journeying and thereafter to deliver them to the Emergency Medical Service. The Army's responsibility ceased when the casualty was admitted to an E.M.S. hospital or placed on any form of E.M.S. transport. Road conveyance to the adjacent port and road transit hospitals of the E.M.S. was performed by Army ambulances, hospital trains were mostly staffed by the Army, a few by the E.M.S. (b) In air evacuation, to receive the sorted casualties from the R.A.F. and to deliver them similarly by road to E.M.S. hospitals and to the railhead.

To cope with these tasks, the Army set up two evacuation head quarters, CVAC (sea evacuation) (fig. 1) and AVAC (air evacuation) (fig. 2) at Netley and Stratton St. Margaret, near Swindon, respectively. CVAC received from the Navy information of the impending arrival of vessels carrying casualties, and, through field ambulances and motor ambulance columns based on Southampton, Portsmouth, and the latter's neighbouring Gosport, arranged the removal of the casualties from the vessels and their further transference in conformity with their state and in close connection with the wishes of the E.M.S. as to destination. AVAC, in touch with the receiving aerodromes on the one hand and the E.M.S. on the other controlled a field ambulance and motor ambulance column for the carrying and road transport required (see figs. 1 and 2).

I shall confine my further remarks mostly to the period from D-day to D+42.

A provisional estimate of casualties has, of course, always to be made before a large offensive. The official estimation of casualties likely to arrive in England during the first fourteen days was 24,520. In the event, the total was only 14,200. This was a relief in many ways, as

Not many abdominal cases were, by mistake, put aboard, but the control of hæmorrhage, the proper adjustment of splints, the treatment of shock needed such expert advice (each L S T and hospital carrier carried whole blood and plasma).

*Professional data* – Even four or five days after injury and without surgery the percentage of infection was surprisingly low, indeed some surgeons with experience thought it wiser not to explore battle casualty wounds that looked well. In my own opinion there can be many reasons given for this low rate of infection. The average American soldier is an athlete, in good condition, and receives well-balanced rations, in this war surgery is taken to the soldier, well forward, and he has the benefit of sulfonamides and penicillin. In June 1944, 75% of wounded received local and oral sulfonamides, 60% received penicillin. Our blood bank makes blood available to every wounded soldier. Thus, resistance is high.

Hospitals for specialized treatment have been set up on the Continent and in the U K. These include centers for neurosurgery, thoracic surgery, maxillo-facial, plastic surgery and burns, and a hand injury center.

The great load is borne by the orthopedic surgeons. During transportation, limbs are immobilized by plaster of Paris. In the general hospital, skeletal traction is maintained.

Of the amputations, 38.3% sustained gas gangrene, with a mortality of 7%. Of 157 cases diagnosed as clostridial infection in the U K. hospitals, 42.6% had gas abscesses, 7% gas cellulitis, 12.1% localized myositis, and 38% diffuse myositis.

What lessons have we learned from the Normandy experience? It early became apparent that definitive surgery for all could not be performed in our forward units because of the load. At one 400-bed evacuation hospital, for example, I saw 250 men waiting for surgery, when empty planes were going to the U K. the same day. Had these casualties been lifted at once their first surgical treatment would have come earlier. The policy was then changed so that only non-transportable cases were given definitive surgery on the Continent.

These special L.S.T.s were not ideal craft for the job but they served the purpose well. Most of them had naval medical staff a few were staffed medically by the Army. Operative treatment, it was decided, was not to be done except in real emergency. The medical officers' task was chiefly to ensure the comfort of their patients by attention to their general needs and to their previously applied dressings. They also did a preliminary sorting which was further elaborated by Army surgeons with previous war experience who were in attendance at the ports on arrival of the craft. Generally speaking patients were far more comfortable on their stretchers in the L.S.T.s than was expected. Seasickness was not a problem. The journey however, took anything from fourteen to seventy-two hours.

The further 'vetting' by experienced officers, already referred to, was of paramount importance. The deleterious effect of further travel on the seriously wounded has been re-emphasized in this war by the far flung campaigns in the Middle East, where it was found that some 5% of casualties required retention for a longer period than the usual twenty-four to forty-eight hours after initial surgical treatment, before being passed further back towards the Base. The estimate made by the E.M.S. for D-day and immediately following in respect of port

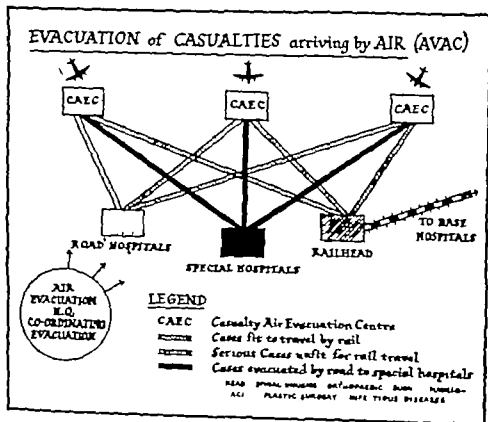


FIG. 2

## EVACUATION of CASUALTIES arriving by SEA (CVAC)

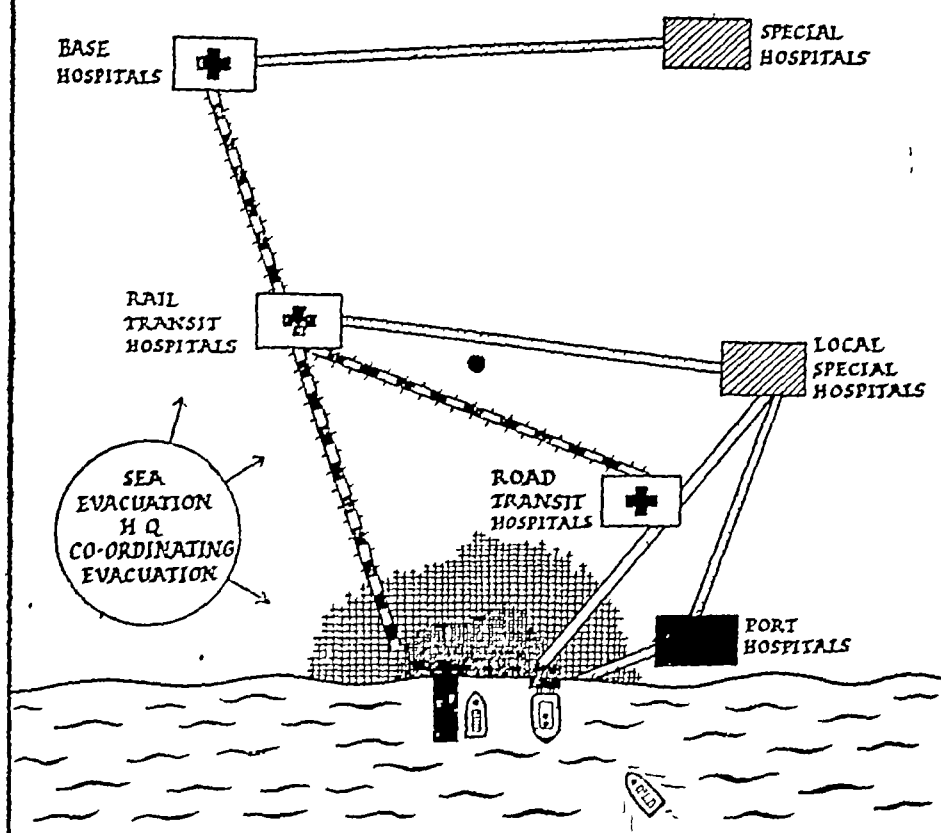


FIG 1

was also the fact that the ports were not bombed, as had been thought not improbable. Of the 14,200, 1,443 arrived by air, the rest by sea. Air evacuation from Normandy did not start till the seventh day.

A chart (fig 3) shows the fluctuations in weekly sea and air arrivals for the first fifteen weeks and how air evacuation gradually and steadily played a larger part.

As was to be expected, many casualties in the first week arrived in neither special L.S.T. nor hospital carrier but were brought across by various other craft. Those not arriving by the special L.S.T.s and hospital carriers were officially termed 'unorganized'. Of the 32,341 casualties arriving by sea in the first six weeks 4,883 (15%) were 'unorganized'. More than half of these, however, are accounted for in the first week. The number brought by L.S.T.s was 18,481 (58%) and by hospital carriers 8,977 (27%). In each of these weeks the largest number was invariably brought by the L.S.T.s but the proportion brought by carriers was rising gradually to almost equality.

applied. But the proportion of severely wounded who arrived untreated diminished rapidly from the first days as surgical units became established in France. The hospital carriers also gradually took on more of the transportation and a larger proportion of casualties were able to enjoy a greater measure of comfort on the voyage.

OCTOBER 1944

## AT A PORT HOSPITAL

JOHN HOSFORD, M.A., F.R.C.S.

*Surgeon St. Bartholomew's Hospital, London, and E.M.S.*

On D-day and for the following eight weeks I was working as surgeon at a port hospital.

During the war I had been working as a civilian surgeon in the E.M.S. in the London area and a number of us were moved from London to the south coast and Southern Counties on the day before D-day to augment the staffs of the local hospitals. Each surgeon went with a surgical team which comprised - in addition to himself - an anaesthetist, an assistant and a theatre sister. I was sent to an ordinary civilian voluntary hospital in Southampton where there were in all six surgical teams. A surprising degree of secrecy had been maintained over the whole of these arrangements and indeed, when we stepped into the bus which went round picking up teams at various hospitals, we had no idea of our destination. One was struck by the fact that civilian life and traffic seemed to proceed in an entirely normal fashion in Southampton which was one of the chief ports from which the invasion armada set forth. One also could not help being struck with the keeping of the secrecy of D-day in Southampton. Although I was there before D-day and so much sailed from Southampton the first I knew that things had started was when it was announced on the 8 o'clock news on the radio.

There were several resuscitation teams who did the preliminary examination of the casualties, note taking and resuscitation. A whole time physician was badly needed to look after some of the awkward problems that arose in connection with resuscitation - dehydration, uraemia and other disturbances of the blood chemistry. Indeed I was struck with the number of these cases that occurred and which might loosely have been labelled delayed, or secondary shock, or some such term, when really on investigation they were found to have a considerably raised blood urea etc.

The function of our hospital at the port was to receive all the badly wounded and ill patients who were not in a fit condition to travel by





the frequent protests raised by the patients against the pain of the injections. They were surprised and distressed when they found that we wanted to continue giving the injections. They had constantly throughout their journey been disturbed, when tired and weary, by the needle and syringe and some had developed a real phobia about injections, so much so that some preferred to be anesthetized by inhalation methods rather than by intravenous pentothal. When my anesthetist approached one patient with pentothal, the latter said that the syringe and needle looked to him like an 88 mm gun with a bayonet stuck on the end of it.

I would like here to say a word about drainage of wounds. In a number of the wounds that we had to deal with, the gauze or other material impregnated with vaseline was acting as a bung rather than a drain - it was preventing pus coming out rather than helping it out. The vaseline gauze may be packed in much too tightly - very occasionally this may be unavoidable if there is profuse hemorrhage or it may have had insufficient vaseline thus causing the gauze to stick to the tissues and seal the wound. Again if the gauze has been packed into a big cavity through a small skin incision, drainage is likely to be bad - this is of course avoided by really adequate incisions in the long axis of the limb. Well vaselined gauze used as a wick instead of a bung and with an adequate skin incision seemed to give satisfactory drainage.

OCTOBER 1944

## ARRANGEMENTS IN TRANSIT HOSPITALS OF THE EMERGENCY MEDICAL SERVICE

ALEXANDER INNES, M.B.E., F.R.C.S.

*Surgical Director (E.M.S.)*

I shall deal mainly with the administrative rather than the clinical aspects of the treatment of invasion casualties. The functions of a transit hospital on the L. of C. can only be carried out if a very high rate of evacuation can be maintained to allow the hospital to meet any possible calls which may be made upon it for the admission of cases.

We had been informed prior to D-day of the possible demands with which we might have to cope, and as these were heavy taking into account the number of available beds, an administrative scheme was prepared to render admission and treatment of cases as automatic as possible.

train farther inland. It was our duty to resuscitate them and do such operations and splinting as was necessary to prepare them for further transport. We aimed at evacuating them after one or two days so that there was a rapid turnover. The number of wounded that were expected and could have been accommodated was never reached.

Briefly, the arrangements in the hospital were that there were 150 beds set aside for battle casualties. There were always three surgical teams on duty and three off duty throughout the twenty-four hours. All patients immediately on arrival by ambulance direct from the quayside were put into the pre-operative wards where they were examined and resuscitated and kept until they went to the operating theatre.

Casualties began to arrive at the hospital in the early hours of the morning of D+1. The majority of those arriving in the first few days required resuscitation to a greater or less degree, but when hospitals had been established on the far side, the proportion requiring active resuscitation was much less. One noticed, however, that those arriving several days after D-day were much more tired than those arriving almost immediately and *greatly* in need of sleep though they may have been resuscitated so far as warmth and intravenous fluids were concerned. With regard to sleep one noticed that those men who had been brought across on a hospital ship had usually had a good sleep and were much less tired than those who had come over on a L S T as did a great many of the men, especially at first, sleep seemed difficult to get.

The majority of cases were multiple limb and trunk wounds often of a very severe type with multiple compound fractures, there were many buttock wounds, a considerable number of chest cases but only a few abdominal ones that had not been operated upon. There were quite a number of severe abdominal cases which had been operated on with excellent results, mostly at Field Surgical Units.

Ordinary standard methods of resuscitation were used – warmth and fluids, blood, plasma, etc. In a very few collapsed patients a dramatic improvement was brought about by the injection of 30 mg of methedrine. We found that considerable caution was necessary in operating on patients who had responded rapidly to resuscitation methods, their pulse-rate, blood-pressure and general appearance may all have returned to normal but when an operation of any magnitude was undertaken, their condition was very liable to deteriorate quicker than other patients.

The arrangements for continuous treatment by penicillin from the battlefield to the base hospitals in this country seemed to work well and patients arrived at the hospital with the yellow PEN label tied around their necks and showing that in almost all cases they had had the penicillin given regularly since it had been commenced in Normandy. But the story does not end there and one cannot forget

sector was in full charge of two surgeons night or day, extra surgical teams being drafted to us from elsewhere to meet these demands. The staffing arrangements were as follows -

(a) *Medical*. - to supplement the normal hospital establishment of

Surgeons - Whole time	5
Part time	3
House surgeons	7
Physicians	2
House physicians	4

on June 5, 1944, there reported for duty at the hospital

Surgical teams - Civilian	3
Army	1
House surgeons	6
Medical students	24

The services of a qualified R.A.M.C. ophthalmic surgeon were also available during the transit phase.

(b) *Nursing* - 102 additional nurses reported from London on June 5 1944.

(c) *Orderlies* - 58 R.A.M.C. orderlies and bearers were allotted to the hospital during the transit period to supplement the 40 civilian nursing orderlies and stretcher bearers.

The physicians were responsible for the running of the resuscitation ward and mobile resuscitation teams, which were available for any ward or theatre on request. A penicillin unit completed the extra personnel sent to us from the sector.

#### RECEPTION - ADMINISTRATION

To speed the admission of cases (and owing to the difficulties in the size of the reception accommodation) the clinical and clerical examinations were spatially separated. The traffic through the reception hut was arranged in three lanes, each patient as he came up to the head of the lane being examined by a surgical specialist, and placed in a clinical category which was indicated by the sticking of a gummed coloured label upon the field envelope A.F.W. 3118/A by the nurse attendant upon each surgeon (fig. 1).

The patient then passed to the reception Sister where he was given a card with his ward and bed number upon it - and the stretcher orderlies then moved him on to the clerical section of the admitting system, which comprised four tables in a covered corridor on each side of the hospital.

Here his A. and D. particulars were taken in triplicate one form being sent with him to the sister of the ward - and the others remaining for the hospital steward and military registrar respectively.

I had feared that this reception system might be the bottleneck which would result in a complete loss of control and delay of incoming cases, but in actual fact our average time for admission was 3.5 cases

Steps had been taken in advance to reduce the number of occupied beds and on June 6, 1944, the bed state was as follows -

Equipped beds available for the reception of battle casualties	1,301
Occupied beds	244
Vacant beds	1,057

### HOSPITAL ADMINISTRATION FOR THE RECEPTION AND TREATMENT OF BATTLE CASUALTIES

The hospital was divided into three sectors - based on the three main operating theatres - each theatre being fed by six wards, and running two tables

Night and day shifts were arranged, with suitable rest periods, so that all theatres could operate the clock round for as long as was necessary, all assistance in the theatres being performed by medical students sent to us on D-day from the sector hospitals, leaving the qualified house surgeons (whose number was also increased), each in charge of two wards together totalling approximately 100 beds. Each

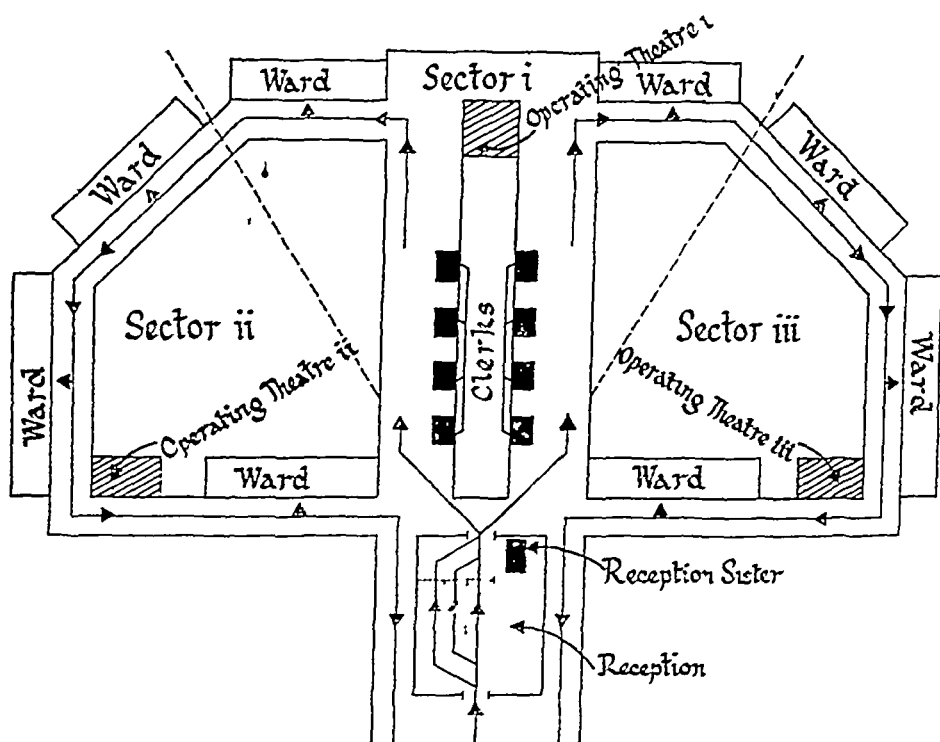


FIG 1

Administrative arrangements of Hospital for Transit purposes

The arrows indicate the course taken by the stretcher bearers from the ambulance unloading point

Cases taken to the theatre were examined in the usual way prior to operation by the operating surgeon, who also indicated into which category the patient was to be placed at the close of the operation - that is, whether he was fit for immediate evacuation (when a yellow label was stuck over the previous green or red one) or whether he was to be retained under observation when a white label was similarly applied over the original label.

The house surgeons in the wards were reinforced by the reception surgeons after each convoy had been admitted, so that a further opinion was always available.

This label scheme worked very well - although I must confess that one patient was anesthetized twice in two hours, due to the adhesive qualities of the post-operation label not being proof against a liberal application of nurse's saliva!

Very few X rays were required the only cases X rayed were:

- (1) Doubtful penetrating injuries of chest, abdomen, pelvis.
- (2) Doubtful penetrating injuries of knee joint.
- (3) All wounds in the region of the skull.

This latter rule was very strictly enforced. On D+4 day an officer with a fractured humerus, a walking case of a previous convoy labelled as fit for evacuation developed a headache, and was found to have a small penetrating wound in the cervico-occipital region of which he was completely unaware. X-ray disclosed an intracranial fragment of metal of not inconsiderable size, and he was transferred at once to our near-by neurosurgical unit, where the fragment was removed and intracranial penicillin treatment resulted in complete recovery.

In the early days, we found that an average of two cases per convoy showed intracranial foreign bodies on X ray without any clinical signs of intracranial damage.

The relative numbers of cases admitted and those upon whom operation was performed is shown in fig 3. In the early days as high as 50% of the cases required operative interference, but this dropped as more C.C.S. and then base hospitals became established on the far-shore, and at the present time convoys admitted require little except an occasional change of plaster or dressing before they pass on to base.

The patients arrived in excellent shape and good spirits. Treatment was good apart from some enthusiastic but somewhat misguided surgery on L.S.T.s and in several cases sutures had to be removed to allow the drainage of an infected wound.

Apart from these, there was a remarkable freedom from pus, and our first real glimpse of laudable pus was when we received our first heavy convoy of German treated P o W.s from Cherbourg. The difference between the condition of these prisoners and the convoy cases which we had previously received was most striking, and under

per minute, which reflects great credit, not only on the admitting staff, but also on the R A M C orderlies who had to perform a long carry – often up stairs, and yet had to return to the entrance to receive the next cases from the ambulances, and thus continue the steady flow through the reception room.

The categories into which the reception surgeons placed the cases were as follows, and were the initial basis for treatment throughout the hospital (fig 2).

Violet cases were directed by the reception sister to a special resuscitation unit. Here may I say that the resuscitation unit was a great 'flop' – our Port colleagues' sorting was far too efficient, and we only admitted directly to that ward 8 cases during our whole time as a transit hospital!

The coloured label on the field envelope displayed on the end of the man's bed indicated to the theatre orderlies whom to take to the theatre, and in what order they should be taken, without any need for reference to any of the ward staff, the red label cases in any one sector being taken to the operating theatre first, and when these had been treated the green label cases were dealt with in a similar way.

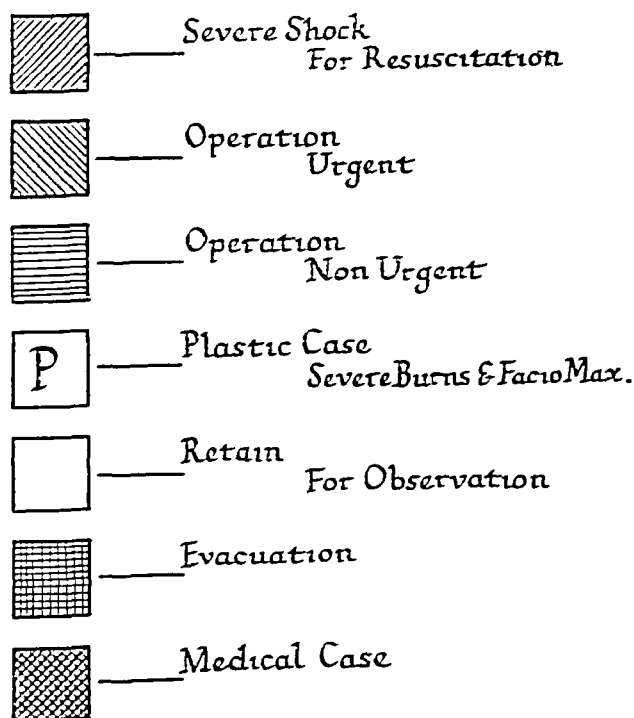


FIG 2

Scheme of clinical categories with coloured label indication.

simply the travelling time which would be taken to reach any particular base.

Any case requiring special centre treatment who was unfit to travel for over two hours was therefore evacuated by road to near by special centres, as also were all Canadians to a Canadian Hospital.

We were fortunate in having maxillo-facial and orthopaedic units in our own hospital, so that thoracic and neurosurgical cases were the only ones it was necessary to transfer

The evacuation by rail or road ran very smoothly and here I wish to pay a tribute to the E M S thoracic centre at Harefield and the Canadian neurosurgical centre at Hackwood which were extremely helpful in every way and with which it was a real pleasure to work. The admissions and evacuations over the period D to D+96 are shown graphically in fig 5 (p 440)

### SUMMARY

(1) The Exercise Galen prior to D-day was most helpful. It gave us much-needed confidence, as although we had made all these arrangements, it was a great surprise and relief to find that they really did work.

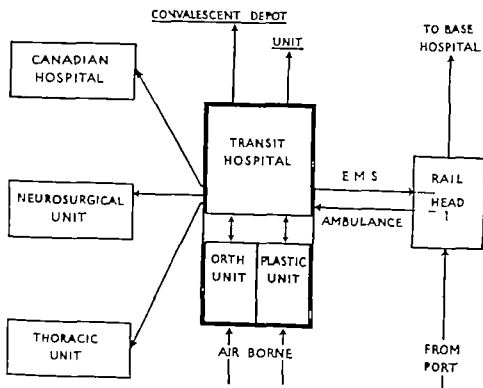


FIG. 4

Scheme of admission and evacuation (Triage) at Park Prewett Hospital during the Transit Hospital period.



lined the advantages of early and adequate surgery supported by the exhibition of sulphonamides and penicillin

This first P o W convoy was interesting from the psychological aspect, as they were fresh from German hands. One German officer refused a transfusion because he thought we were giving him Jewish blood, and a few cases became completely uncontrollable and hysterical in the anæsthetic rooms; they were certain that it was a gas chamber, and that they were going to be killed.

We had little trouble in the wards with them; one rather excitable young Nazi spat at a nurse, but was treated with apomorphine and quietened down, and as opposed to this, many on leaving the hospital have expressed their thanks to the sisters and nurses.

Complete evacuation is as important a feature of transit work as rapid admission, sorting and treatment, and the scheme of admission and evacuation for all cases is shown in fig 4.

Initially we had not considered any triage to special units at this transit level, as we thought that the base hospital should provide these amenities; but such triage was forced upon us by a number of factors, the chief of which was that evacuation trains were carrying patients to base hospitals in the far North of England and not a mere two to three hours' journey away as we had originally been led to expect.

Thus the principle governing the decision as to whether a patient should be sent to a special centre by us, or should continue by rail to base where a further shift to a special centre would take place, was

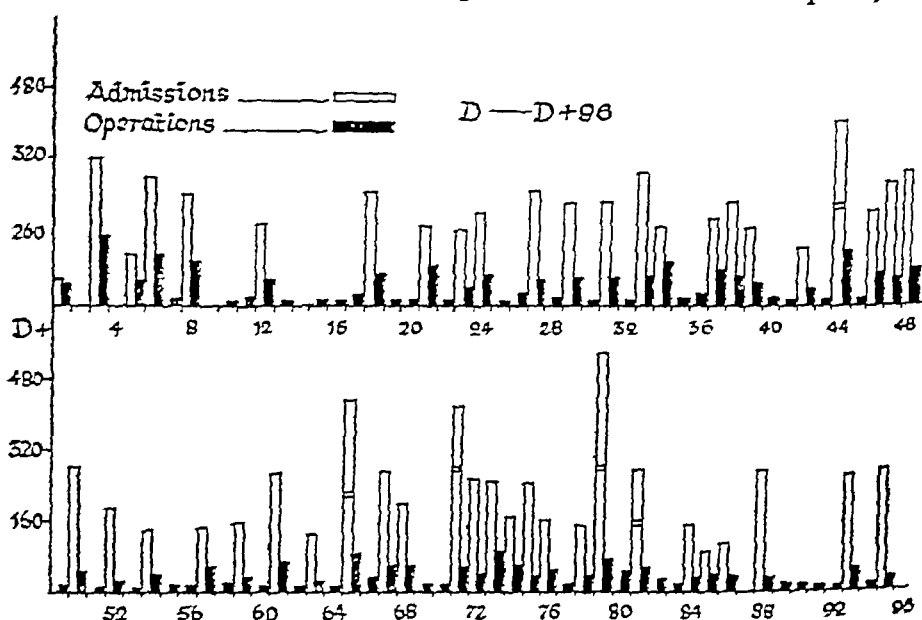


FIG 3.

Comparison of admissions and operations performed during the first 96 days of the Transit Hospital period

NOVEMBER 1944

RECEPTION AND DISPOSAL OF AIR BORNE  
CASUALTIES

AIR VICE-MARSHAL GEOFFREY KEYNES

*Senior Consultant in Surgery R.A.F*

The part played by the R.A.F. in the evacuation of casualties from the battle front is necessarily limited. It is but a *link in the chain*, though extraordinarily important if its value is recognized as we of the R.A.F. think it should be. It has not been neglected on the European front, for some 40 000 casualties have been so evacuated to this country since D-day - quite a high proportion of the total casualties. The R.A.F. has in general been responsible for the patients from the moment they arrived at the air-strips on the Continent until in the hospital or ambulance train to which we have sent them. This has necessitated their being sorted by us on one main occasion, that is at their arrival on the particular airfields in the Midlands from which the whole organization has been worked by Transport Command. The general picture of Air Evacuation has been described by Air Commodore Cade at a previous Conference. We are concerned now only with the problem of sorting but this does necessitate references to other parts of the chain in which the R.A.F. forms one link.

How does transport by air affect the different kinds of injuries from which the patients are suffering? The answer is simple - hardly at all! Carriage by air is usually smooth in the type of machine used, and they do not as a rule go higher than 3 000 feet, an altitude not great enough to have an injurious effect on the types of patient chosen for air evacuation. Patients' impressions of the journey have almost always been that much the worst part was the ambulance ride over bad roads from the holding unit to the air-strip. Occasionally patients with abdominal injuries complain of distension and wind, colic while in the air and colostomies will usually evacuate faeces during the journey. Otherwise there are no effects, and sorting of patients is scarcely affected by their having been airborne.

The main factor influencing sorting has been the rapidity with which the patients have so often travelled from forward units to the home base. We have seen many casualties within a few hours of being wounded, so that the air-port has sometimes been virtually a front line unit in ensuring early treatment. It is even necessary to avoid being deceived by *post-anesthetic vomiting* due to operation done on the other side.

The first casualties received by air from Normandy arrived on D+12 although it had been anticipated that we should not begin to function until D+40

(2) An administrative comment which I must make is that we were not given enough information concerning particularly the research and pathological services, which we were expected to feed with cases, and who were to be billeted upon us. The result was that an unheralded R A M C pathologist arrived some little time before D-day and neither we nor he knew what he was supposed to do. Similarly, having been categorically informed that no penicillin unit was going to be allotted to us, a gentleman and four dressers arrived the following day, stating that they were a penicillin unit, requesting accommodation, and a large number of seriously wounded cases.

Considerable alteration in internal administration was necessary to provide them with their requirements and it would have been better had we known in advance of their coming and the scope of their work.

(3) My last comment is a clinical one. The plaster of thoracobrachial and Tobruk splinting was put on far too thickly. Up to D+10 they were good. Thereafter they were like concrete and if you have ever tried to cope with a secondary hæmorrhage in a thick thoracobrachial box you will know what we feel about it.

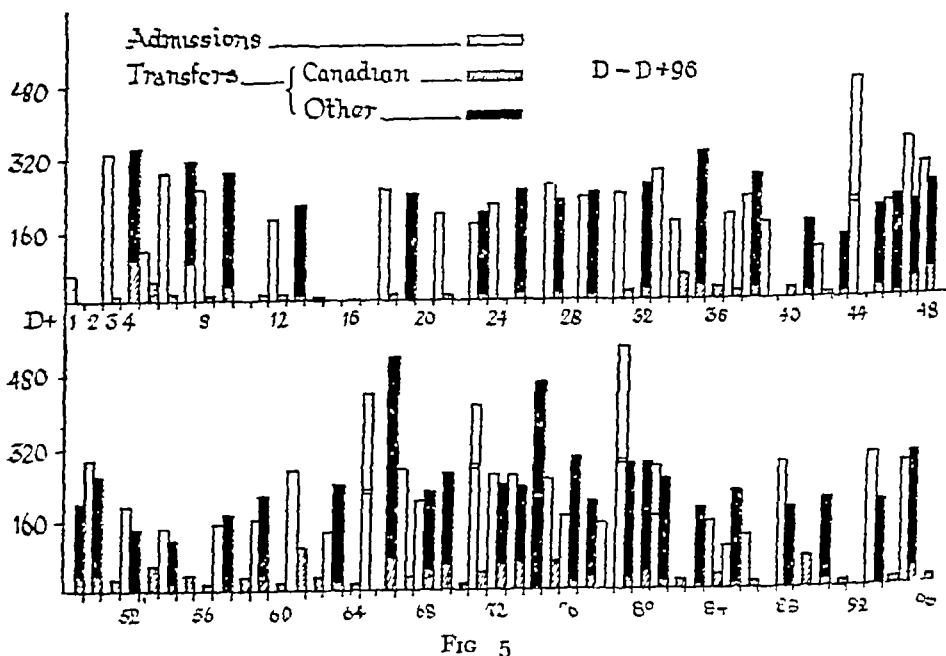


FIG 5  
Admission and discharge of cases for the first 96 days of the  
Transit Hospital period

category (B) the train patients, must surely be 90%. This belief was based partly on experience of evacuation by sea, partly on the fear that hospitals near the airports would be overwhelmed if category (A) rose above their arbitrary figure.

Let me examine the *mental processes* of the officer responsible for sorting. Sometimes as I watched him going round the crowded huts I felt he must be possessed of second sight. Bad light, difficult writing, inadequate space, clothes, blankets, bandages and plaster casts, all hindered access to the patient and his individual problem. Sometimes two or three hundred patients arrived in the course of an hour or two, and the sorting officer had to make his decision in an average of two minutes for each patient. Often he had to try to reduce this to one minute, if the (B) patients were to get to their train in reasonable time. A man's limb or even his life, and often the period of his ineffectiveness, depended on this decision.

The sorting officer had to get used to making his decision so quickly that his mental process was an unconscious summing up of a complicated picture held in the back of his mind - a picture formed of knowledge of what had gone before, mostly derived from a sometimes illegible card of notes observation of present conditions and finally, knowledge of what was going to happen to the different categories when they had been sorted. What had gone before - and how little of what the man had suffered and endured could be known in the sorting officer's rapid survey of his patient! It could be ascertained, however how many hours ago he had been wounded and what treatment he had received. The particulars on the field cards were usually most admirably done without unnecessary elaboration, and obviously, many of the officers concerned had gone to great trouble to make their records legible. With these main facts his history could be rapidly reconstructed and its bearing on his present condition assessed.

What was to come - this was based on day to day, often hour to hour knowledge of the number of ambulances available, the distances of the receiving hospitals, their bed state, the probable time of departure of the trains, their capacity time taken in loading and unloading and the distance they were going to travel - though this information was often impossible to obtain.

The assessment of the patient's present condition is naturally the most important and difficult problem of all. There is no time for detailed questioning. The best plan is to have a small number of almost routine questions, easily asked and easily answered. Of these the two main ones are 'Are you in pain?' 'Do you want food?' A very great deal can be inferred from the answers to these two alone. Complications are sometimes introduced by the need to sort by nationalities as well as by wounds, for special arrangements were made for the disposal of Americans, Canadians and prisoners of war.

Removal of dressings is to be avoided if possible usually palpation

I am now concerned primarily with the clinical side of sorting wounded but the process is an administrative problem as well, and it is hardly surprising that administrators and clinicians did not always see eye to eye. In this connection I quote from a report by one of the younger R A F medical officers mainly responsible for sorting of casualties and decisions as to their disposal. After his first four weeks of work he wrote -

'The administrative side of the sorting and disposal was for the first three weeks a continued source of headache, with argument and nonsensical decisions forced on the unit and the local Army Evacuation Headquarters by authorities equipped only with short-sighted policy, and almost completely lacking in knowledge of the finer points of Air Evacuation.'

This was written in the heat of battle during the birth pangs of what was for this country a new method of evacuation of casualties. Its enormous advantages and special conditions were not at once perceived by all the authorities concerned, and they had to be convinced of facts which seemed to us, on the clinical side, so obvious as hardly to need stating. Nevertheless, a situation did at one time arise where the administrators tried to insist that clinical sorting must conform to a preconceived pattern, whereas we, who were concerned with men instead of paper, knew that this standard could not even be approached without grave injury to the wounded in our care.

Let me explain the circumstances in which the sorting was done. As soon as the transport planes had taxied to the ambulance station, the patients, mostly on stretchers, were taken out as quickly as possible, loaded in the ambulances and taken to the near-by sorting huts. Stretchers were placed, thirty in a hut, along either side on iron trestles, brick supports, or petrol tins. Sorting began immediately while orderlies, male and female, ministered to the patients' comfort. The unloading from the planes was supervised by an officer who, if he noticed any patient in a critical condition, ordered his immediate removal to Station Sick Quarters. Fortunately this happened very seldom, as good judgment had usually been exercised in loading the planes.

Sorting was primarily concerned with deciding which patients should be taken by ambulance immediately to a hospital in the neighbourhood and which should be sent for distribution by hospital train to more or less distant parts. The first category (A) were those judged to need immediate surgical treatment, close observation, or a rest before being sent on a journey of any length. The second category (B) were those judged fit for a train journey and whose further surgical treatment could be safely delayed for twelve to twenty-four hours or longer.

This was the crux of the matter.

The administrators were firmly convinced that category (A) patients could not possibly be more than 10% of the whole, and that

condition had undergone a profound change. He was now a ghastly colour and showing every sign of hæmorrhage - blood was welling from the long leg plaster around his toes - there was obviously a second ary hæmorrhage from a large vessel. It was then realized that pus had previously been seen exuding round the toes, but this had not registered properly in our consciousness. It was now clear that it was being pushed out by the blood then still within the plaster. Appropriate measures saved his life, but how nearly we had failed. Had the hæmorrhage taken place in the ambulance or in the train he would have died.

I have dwelt on the anxieties which must constantly be the lot of a conscientious sorter, but it must be gratefully admitted that his task is greatly lightened by the provision of special centres to which all patients in certain categories are sent. These include head injuries, spinal injuries, facio-maxillary injuries, recent chest wounds, and more serious burns. In judging these categories sorting becomes almost automatic.

A small category which has hitherto caused considerable anxiety includes those with injuries to large blood-vessels, especially those in the lower limb with uncertain circulation below the injury. It is now proposed that these also shall be automatically segregated - largely for clinical investigation, though it will also favour the saving of life and limbs. We have also seen many patients with high amputations through the thigh and grossly septic stumps evacuated between the fifth and tenth days. Here, risk of secondary hæmorrhage is very great, and I have always advocated immediate ligation of the superficial femoral artery in Scarpa's triangle under local analgesia. The patient can then be evacuated by train with perfect safety.

Having indicated some of the principles to be observed in sorting for evacuation, I must now give some account of what has happened up to date. For the first month after air evacuation began, the percentage of category (A) was frequently 30% or 40%, and sometimes rose as high as 75% or 80%. All administrative calculations were falsified and the battle of the percentages became a major issue. The R.A.F. was accused of having a wrong attitude in their sorting, and changes were demanded. We on our side were perfectly sure of our ground and with the support of our superiors we refused to allow our clinical judgment to be made subservient to administrative prejudice. It was clear to us that on the other side of the water the advantages of air evacuation were so fully appreciated that the more severely wounded men were being selected for sending by air and that this was bound to raise the (A) percentage far above the prescribed 10%. Moreover air evacuation was so prompt that in the early stages of the invasion many men reached us entirely untreated, save for a first field dressing so that urgent surgery for many of them was a prime necessity and a matter of first principles.

of the limb or part of the body close to the bandaged wound will give the needed information. Tenderness, swelling, and induration, are all indications for surgery. Their absence is an assurance that treatment can wait. Of course the presence of retained foreign bodies must often be guessed at. There is no possibility of routine X-ray examinations at this stage. Many patients have X-ray films with them, but many more do not. If the decision is in doubt after this superficial examination, the dressings must be taken off by one of the nursing staff while the medical officer continues his round, to return later to look at the exposed wound. The experienced sorter very seldom needs to do this.

Another part of the routine is to note the character of the patient's pulse. The value of this is in detecting toxæmia. A rapid pulse is common in wounded men particularly after operation, and does not necessarily mean unfitness for travel. But a bounding pulse, i.e. high pulse pressure, is a very important sign and easily felt. It warns the sorter at once to be on the look-out for a toxic state, whose source may be completely hidden beneath bandages, or, more often, a plaster cast.

This introduces a subject which looms large in the sorter's eyes. The value of plaster casts for movement of casualties with fractured bones or extensive injury to soft parts cannot be exaggerated, but it also cannot be denied that they provide the most difficult problem of all for the sorter. It is hardly ever justifiable to remove a plaster case, and the messages written on them in indelible pencil, with dates of operations, sketches of the positions of bones, and warnings such as *WATCH FOR GAS GANGRENE* and *WATCH THE TOES*—are extremely helpful to the sorter. Still, faced with a plaster cast he must exercise his own unbiased judgment with all his senses alert. Among these, smell takes a very important place. The sickly odour of gas gangrene under a thick plaster *spica* must never escape him (*hence, he must never have a cold!*). His anxieties are much lessened, however, by the knowledge that not all these smells mean true gas gangrene. He is alive nowadays to the distinction between massive gangrene of muscle and gas cellulitis, that is to the profound constitutional effect of the one and the relative absence of any effect in the other, though the smell may be the same. Another routine question is 'CAN YOU MOVE YOUR TOES?', their colour and temperature being at the same time closely observed. Yet, however careful our sorter, he may still be deceived by events taking place beneath a plaster. A few days ago we had paused longer than usual over a man who had a compound fracture of his right upper arm and a full thoracobrachial plaster cast, a compound fracture of the left ankle with a plaster cast up to the knee, and a compound fracture of the right tibia, with full length plaster from the toes to the pelvis. In spite of everything his general condition seemed good, and there was no smell. His pulse was rapid, but not bounding. With a little hesitation we marked him (B). Ten minutes later his

training. This included practice assault work and embarkation of casualties.

On the outward trips to Normandy men, tanks, vehicles and guns were carried, and very rapidly discharged on arrival. Then came the most astonishing metamorphosis. As the vehicles were driving out of the tank deck, the deck was scrubbed, stretcher brackets were rigged, the resuscitation apparatus and operating theatre were got ready. Naturally no red cross could be displayed on this ship. It was imperative to have the hospital ready immediately the last vehicle left. I am glad to say that we always managed to do this. In landing ships, one must co-operate with the tides.

Metamorphosis in reverse took place at the home port. The casualties were rapidly disembarked, the stretcher brackets were stowed away and lashed down, supplies of blood were replenished by a very efficient organization which never failed us at whatever port we touched. The ship once more took on its load of tanks, vehicles and men.

Conditions for treatment whether it be blood transfusion or surgery were naturally those of a forward area. The weather was not entirely kind to us in those days. That brought all sorts of complications for everyone. Vacolitters must be secured to the stretcher brackets to prevent breakage by rough weather. Cutting down on a vein in a bad sea may assume the proportions of a major surgical adventure.

Seasickness aggravates shock, and has an adverse effect on any patient, but fortunately hyoscine was a great remedy. Blood ages more rapidly with vibration and shaking. The blood suffered inevitably from beaching, vibration of the ship, the pounding of the sea, the ship's anti-aircraft fire, and near misses from bombing and shelling. We never kept a batch of blood for more than 2 trips, even if there was any left over. The blood used was never more than fourteen days old. The remainder was landed in exchange for fresh supplies.

The blood was stored on board in a refrigerated compartment. It found itself co-tenant with the meat and the cheese. There seemed no reason why the symbiosis should be unsatisfactory as all three occupants contained a considerable amount of protein! However, we were to experience difficulty here. Although the compartment was fitted with a temperature indicator and an adjustable valve, we found that frequent demands for the meat and cheese caused unwelcome changes in the temperature.

I persuaded the engineer officer under whose charge were the cool rooms, to dissolve the partnership with the meat and the cheese, and we had the room solely for storage of blood, plasma, sera and penicillin. It was necessary to maintain a rating on continuous watch on the temperature dial, with logging of the readings every two hours. We kept the blood between 40 F and 42 F and had no further trouble.

Treatment of cases in forward areas, whether it be resuscitation or surgery must necessarily be swift. In fact everything depends on



As the situation in France became more favourable for giving full treatment there, the position gradually changed. More and more patients had spent many days in hospital and were plainly convalescent. Fewer and fewer arrived untreated, and ultimately we saw none of these. So the percentage of category (A) fell, and category (B) rose, now for many weeks (A) has been well below 10% and (B) well above 90%. The administrator is satisfied, but the sorter can never be relieved of his grave responsibility and recurrent anxieties.

During the subsequent discussion, the D G A M S explained that 'The Battle of the Percentages' was really a conflict between the views of two sets of clinicians, the estimate of 10% and 90% having been made by a surgical consultant. The administrators were only proceeding on clinical advice.

This statement led the surgical consultant to admit that, in fact, he had been responsible for the figures, which were based on previous experience, though he pointed out that he had been asked to advise on the basis of beginning Air Evacuation at D+40.

It then became plain that the whole trouble arose from the administrative attempt to fit the picture of D+12 into the frame of D+40, a misunderstanding for which the R A F organization could not be held responsible.

Whoever may have been right in the 'battle of the percentages,' the overriding factor was the necessity to keep the port and transit hospitals from becoming clogged, even at some risk to the casualties. If evacuation was not sufficiently rapid, not only would later convoys have severely suffered, but the general organization for the evacuation of wounded would rapidly have become chaotic. — [EDITOR'S NOTE.]

## D. — BLOOD TRANSFUSION SERVICE

APRIL 1945

### THE BLOOD TRANSFUSION SERVICE

SURGEON LIEUTENANT-COMMANDER R N MARTIN, F R C S, R N V R

*Surgeon, H M Tank Landing Ship No 363*

I propose to speak of a particular aspect of blood transfusion. I refer to the assault on the Normandy beaches, and the subsequent evacuation of casualties by medically manned tank landing ships, or L S T as they are officially known.

I had the honour to be senior medical officer and surgeon in one of these ships from D-day to D+24. We had a team of 3 medical officers, 15 sick berth attendants, and 16 specially trained seamen and Royal Marines. This total of 34 had all undergone special preliminary

was at death's door on reaching us. I advised against transfusion as there were others seriously ill, but with a better chance. One of my medical officers pleaded with me, and gave him a transfusion, but to no avail.

It follows then that if blood is to be used at all it must be used on cases who would possibly not recover without it, and it must therefore be used in adequate amounts. Under these circumstances I consider the minimum to be 2 pints. Perhaps an exception to this is a chest wound.

Most of our transfused cases had 3 pints, and some had more. Open venesection was necessary in many cases, collapsed veins of the largest calibre are often difficult to find by closed methods. An additional advantage of the open method is that the cannula is less likely to come out, and the case may be transported after disembarkation with the transfusion running. Incidentally one case with transfusion running was received from a DUKW on D-day which had weathered 1 mile of very choppy sea.

When it was necessary to cut down, the leg was used in preference to the arm. Patients are very much more comfortable with a transfusion running into an extended leg than into an extended arm. They can also be nursed more easily.

Our indications for transfusion were based entirely on the clinical appearance. You can well realize that we had neither the apparatus nor the time for recording blood concentration, blood pressure or shock curves. In a ship owing to the noise, the stethoscope has so much competition that it loses its value. The colour of the patient, his pulse, his warmth or his lack of it, were the most important clues to the need for transfusion. Similarly transfusion ceased when the patient improved, and the phenomena were reversed.

Our most dramatic case in the early days of the invasion was a soldier who came on board with a severe compound fracture of the lower third of the femur to which a tourniquet had been applied on shore. He was in very bad condition, and had obviously lost much blood.

Resuscitation was commenced at once, and the tourniquet removed. There was no further bleeding. After a blood transfusion had been running a short time he bled from his wound and it was necessary to re-apply the tourniquet. The bleeding vessels were in the depths of the wound and could not be caught with hemostats. Shortly afterwards, in spite of resuscitation measures, his condition became worse, and his radial pulse was imperceptible. The transfusion was accelerated by means of a rubber bulb from a scent spray but he deteriorated further. His eyes became glazed, and he was nearer death than we cared. As a last resort we got a second transfusion going in the other arm, fortunately without having to cut down. Thus we also accelerated, and he was now receiving two accelerated transfusions.

speed. That means you must have an efficient system for reception of casualties. The man who requires transfusion must be picked up at the earliest moment and dealt with at once. Triage was all important. When you embark close on 300 wounded in two hours you cannot afford to have bottlenecks, and yet you cannot afford to examine a case carelessly or not at all. In actual fact we had a bottleneck, but it did not slow the embarkation at the far shore, and it did not enter into conflict with those all-important tides.

Our bottleneck was not a worrying one. Many of our casualties were received from DUKWs, some from ambulances.

In order to let the DUKWs and ambulances get away for another load we unloaded the stretchers direct on to the deck, and no stretcher was placed on the stretcher brackets until I had examined the patient. This meant that triage proceeded for some hours after embarkation was complete. Cases needing resuscitation were marked with an 'R' on their foreheads in indelible pencil. They were automatically placed in the resuscitation ward.

This so-called ward was simply the 30 stretcher brackets nearest the operating theatre. At this end were my two resuscitation teams each with one medical officer and an operating room attendant. The latter was not required for surgery until triage was complete. Transfusion was commenced in some cases while we were still at the far shore.

A little earlier I said you must be swift in your decision to transfuse or not. You must be quick if you are to get through the day's work. On D-day some 187 casualties were embarked, and many of these had had little done before arrival, due to the confused nature of the landing in the early stages. Some wounded arrived with compound fractures immobilized by tying the good leg to the injured one.

You cannot afford to say 'I will re-examine that case in half an hour with a view to transfusion.' You must decide there and then. It is a question of doing the greatest good for the greatest number, and in the shortest time.

In the later stages of the invasion the need for transfusion was not so great. Only one resuscitation team was necessary, the free medical officer assisting with reception and triage.

*The practical side of transfusion* - We reserved blood for cases of hæmorrhage, and for infected cases with marked toxæmia. We used plasma on cases of shock in whom hæmorrhage was not a marked feature. We saw no major cases of burns.

There is a temptation in civil surgery in quieter surroundings than ours to give a pint of blood or plasma to a case who is mildly shocked, and who would recover without it. In surgery that temptation must be resisted. You must not waste blood in the time, and thus jeopardize the lives of other cases. At the critical scale you must desist from transfusion in cases in extremis, particularly now of a man who had a four-old wound, and who

## SECTION XII

### German Concentration Camps

#### Conditions of Liberated and Displaced Persons

*Conference on June 4, 1945*

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Perhaps this was contrary to the principles of physiology, but we got a good result. After he had had 1 pint he began to improve, and we slowed the rate. After 4 pints he was fit enough to have surgical toilet of his wound under pentothal anaesthesia. The lower two perforating branches of the profunda femoris artery were ligated, and the limb was put up in a Tobruk plaster. After the fifth pint the transfusion was discontinued. He was of ruddy countenance, and well enough to be moved to a hospital 3 miles from the port of disembarkation.

There seems to be an optimum time after transfusion when surgery should be undertaken. It varies in individual cases. If it is necessary to operate in forward areas, and it often is, it should be done either towards the end of the transfusion or within one hour of its termination. Those cases which require urgent surgery seem to go downhill again if left too long after transfusion.

As for results I can only speak in general terms. We lost track of our cases in those hectic days. We had time to issue follow-up cards only to a few. We saw no reactions from transfusion. Our mortality was 0.5% while cases were on board.

Blood transfusion is not everything. In the early days we had wounded who had not had a square meal for three days. It was more important to feed them than to transfuse them. The ship's galley managed to give all wounded a meal within four hours.

I should like to conclude with an extract from the Regulations and Instructions relating to His Majesty's Service at Sea in the year 1806 –

*'The Surgeon – He having the charge of the lives of so many useful subjects of this Kingdom, who from crowded accommodations, the varieties of weather and climate are liable to infectious fevers, scurvy and also to wounds and hurts incident to their mode of life*

*The guarding against these evils will depend very materially on his promptitude in applying the most speedy remedies*

*As sickness in the most favourable situations ashore depresses the spirits, much more must it affect his patients on board Ships of War, labouring under so many inconveniences which cannot be remedied*

*In these circumstances it becomes his duty to exhilarate their spirits and add to their hope of recovery, to which it cannot fail to contribute'*

Those words might well be applied to blood transfusion one and a half centuries after they were written.

## EXPERIENCES OF A MEDICAL PRISONER AT BUCHENWALD

PROFESSOR CHARLES RICHEL (Paris)

*Membre de l'Académie de Médecine*

I was arrested just two years ago. The Gestapo did not know exactly why they arrested me, which was very fortunate for me, but the Germans very much appreciate family life, and they showed it by arresting my wife, my son, and my niece and putting them in gaol. But gaol is one thing and a concentration camp another. On the journey we were sixty-two hours without a drink, and many died in consequence. Many tried to escape, some succeeded, and during the ensuing night we heard shooting which indicated that some at least of those who escaped had been killed. I saw some men who showed signs of madness.

Presently we arrived at Buchenwald. As we went through the door at Buchenwald we saw a great picture in which the figures were a monk, a Jew, a priest, and a policeman, and the policeman was putting the other three in gaol. It was a symbol of our life there. Our heads were shaved, we were bathed, and clothed, but clothed very badly, and in the bitter weather we had no shoes, no gloves, no overcoat. The barracks, which were 50 metres long and 10 metres wide, contained about 750 when we arrived. The numbers in the block rose in 1945 to 1,500 and then to 2,100. Many fell ill, but there was very little room for them in hospital. A number of our comrades died in the blocks, about two people died every day in our block, and within one month 10% of our comrades had died. I escaped only because in the fifth or sixth week I was taken to work as a doctor in the hospital where I was much better off.

Buchenwald was established for 10,000, but when we came there the total number was 25,000 men. It was said to be a good camp, but I saw some people who died of the blows they received there. I speak here as I would speak in a court of justice, and I do not want to say anything which is only hearsay. Some people were shot without trial. I remember that in September twenty were killed. Some of them belonged to the British Intelligence Service, some were French men who had tried to make their escape. Once more French and English blood was mingled.

As for conditions in the camp, the German goodness was great! We were allowed from time to time to spend six or seven hours out in the snow, but without gloves or overcoat. We had to work some twelve or thirteen hours, and after that the military roll-call, which was supposed to last one hour, but customarily lasted much longer, some callings lasting even twenty-four hours. Our overcrowding was perhaps



good convict is dead after six months in this camp. We could not do very much for the sick. We had a few medicaments, but all those had to be used for the people who might probably be saved.

Did the German people know of all this? It is hard to think that they did not, with 20 great camps and perhaps 200 little ones, all under the rule of 'Himmlerism'. To-day we are living in days of Victory but in the midst of Victory let us spare a thought for the men - I naturally think of France - who died in these camps, but through whom the spirit of resistance lives on.

JUNE 1945

## GERMAN CONCENTRATION CAMPS EARLY MEASURES AT BELSEN

BRIGADIER H. L. GLYN HUGHES C.B.E., D.S.O. M.C.

*D.D.M.S 2nd Army B.L.A.*

My remarks will concern Belsen as it was before and after we liberated it, the conditions we found there, and the difficulties we had to overcome.

By means of hostages, the Germans intimated to us that there was within their lines a concentration camp containing 1500 cases of typhus, but at no time did they give any indication of the appalling conditions we were to find there when we captured the area. As events proved, there must have been between 10 000 and 20 000 cases there.

In all, they stated that there were about 55,000 prisoners in two camps in the area in the smaller situated in the local barrack area, were 15,000 men who had not been there long - a week or ten days. There was no typhus, and not a great deal of disease amongst them, but varying degrees of malnutrition. In the actual concentration camp were 40 000 men and women and a considerable amount of disease of all kinds, including typhus.

Two British officers went over to the German lines to discuss how the situation could best be dealt with. The Germans were asked to give up the whole area, but they naturally pointed out that this would turn the whole of their defensive position on the right flank it was therefore agreed that no troops should be deployed within the camp perimeter and that no artillery fire should be directed into or from the area. The German commander was to ensure that all S.S. except those required for administration, should leave the camp before the arrival of any British force those required must be disarmed and would become prisoners. A battalion of *Heimwehr* was to be kept to act as guards and prevent the escape into the surrounding country of



the worst of our miseries. We were truly in a rabbit coop, and not one of modern construction either. Related to this was the misery of starvation. As we all know, about 3,000 calories is needed for those at work and for all when it is cold, but for a long time during 1944 we had only 1,750, and later only 1,050. The food was the general food of a convict camp. We had one litre of soup, and at the beginning 500 gm of bread and 25 gm of margarine. Sometimes this was supplemented, but during the latter part of the time we had 200 or 300 gm of bread only, and very little margarine – perhaps 15 gm. My son was in Belsen at the end of April, and for five days he had nothing to eat.

In these camps there were not only political prisoners, but criminals – robbers, murderers, blackmailers. This convict camp was far from being a democracy. The word ‘camarade’ was much used, but it was nothing but a word. We were not comrades, we were a group of human convicts, some of whom had been there for ten years. Some were quite good, but others were simply brutal. In a word, we were a mob. The transport conditions outside the camp were sometimes normal, but at other times frightful. I know of a case where 30% of the men who were transported in uncovered wagons in the cold weather died.

*Mortality and morbidity* – Five diseases were widespread. One was erysipelas, of which there were about 1,500 cases in less than one year. Pneumonia showed an incidence of from 12 to 15% every year. Dysentery lasted in a severe form only two months, but in that time it killed between 3,000 and 4,000 men, the mortality being more than 50%. We had six epidemics of typhus, all of which I saw. But I think the most terrible disease was tuberculosis. It killed its victims, not in two or three months, but often in four to six weeks or less. Most of our patients had what I call the *hunger complex*, and I think the starvation was the same in all the camps. A man might lose 20 to 40 kilos, and be in a state of great general weakness. Blood-pressure was always very low, and at the autopsy we always found myocarditis.

Morale soon began to diminish under these conditions. Men whose comrades had died would conceal their death for a few days in order that they might get the dead man's soup as well as their own. I have known cases in which men have been killed in order that those who killed them might have their bread ticket. My son told me that in some cases even corpses have been eaten. Starvation means a general collapse, physical and moral. Death is always ugly, but I think that

Apart from the frightful conditions in compounds and huts there were many other horrors – the enormous piles of dead lying everywhere, a crematorium, a gallows in the centre of the camp and signs of mass burial – one enormous grave open and half filled on our arrival.

That is a broad picture of Belsen. The magnitude of the task was not really apparent until one got into the huts, and one was faced with the appalling stench and the sight of countless numbers of miserable skeletons herded together on the floor or in bunks, often four to a bed, and the living sharing with the dead. In one hut were counted twenty women in 35 square feet – the bare minimum of space allotted to one British soldier in the most crowded conditions. There were few blankets and many were without clothing at all – there was no straw and few rooms had bunks.

That first night the priorities were food, water and more troops. Despite the evidence of ample stocks of food in the neighbourhood there had been no food or water issued for seven to ten days. The task of cleansing the area seemed at first insuperable, and the first essential was supervision by more troops, particularly directed to administration.

What were we to do straightway? It was first decided to give the best chance of survival to the greatest number – and therefore to move out at once into the barrack area – the supposedly fit and well – thereby making more room in the huts and supervision of feeding easier.

For many reasons it was not possible to implement these ideals in full, which included the careful selection of the next cases to be moved in order of priority – and it eventually came to a question of evacuating hut by hut.

The fact that there was a good barrack area which could be converted into a hospital undoubtedly saved the situation and, in addition adjoining this area, was a beautiful military hospital of 500 beds, and a large officers' mess, in which the dining room alone could take 200 beds.

The main difficulty of course, was equipment for the barrack area and it was obvious that this could not come from British Army sources in the amount required. Eventually 14,000 beds were equipped from every conceivable source, by combing out – too, a very wide area of country.

The other cry – and the most important – was for more help. We made use of what German doctors and nurses were available from those who had been made prisoners, and asked at once for the help of the Red Cross, U.N.R.R.A. and any other available source.

The arrival of 97 medical students from the London teaching hospitals proved the greatest help and with their advent the death rate, which in the earliest days had been 500 per day – began to drop appreciably. With their knowledge and enthusiasm we were able to exercise much better supervision in each hut – they worked splendidly

any internees who might be infectious, but as soon as the British forces could take over this duty, the *Wehrmacht* would be given safe conduct back to the German lines

Although it would be the 11th Armoured Division which would capture the area, it was evident that the control and cleansing of the area would become a 'Second Army' problem. At the time we were still fighting hard, it was indeed one of the most important periods of the campaign, because we had got the German Army on the run; as a result every British division was heavily engaged.

The demands on our own medical services at that time were very great, with fighting commitments alone, but in addition there were vast numbers of displaced persons streaming back, and also large collections of German wounded in the many hospitals, both military and civil, on the line of our advance, both heavy medical commitments. The medical units available were therefore very few and all that could be spared initially was one casualty clearing station, one light field ambulance, and two field hygiene sections.

Belsen, as we saw it on the day of its liberation, April 15, 1945, can be described as follows. -

Camp I, referred to as the 'horror camp,' contained 40,000 people, made up of approximately 28,000 women and 12,000 men. At the entrance was an administrative area, where were situated offices, accommodation for guards, stores, and prison cells. The camp proper was a heavily wired perimeter with guard towers spaced at regular intervals around it and from which for the first forty-eight hours continual shots were being fired. The perimeter enclosed five compounds, four on the left and one on the right of a broad road running through the camp. Three of these were for men and contained numbers varying from 1,500 to 8,000. The two for women contained, the one on the left, 5,000, and the other on the right, 23,000. The whole camp was originally built to contain 8,000 and on our arrival we found 40,000 living, whilst on the ground were 10,000 corpses, and it was further reported that, in addition, 17,000 had died during the previous month of March.

After a quick survey of the whole camp area an estimate was made that 25,000 required immediate hospitalization and of this number 10,000 would probably die, despite all efforts. These figures proved to be very near the mark, although the number of deaths after liberation was higher, approximately 13,000.

In the camp there was no sign of hygiene at all, huts which should have contained at the most 80 to 100 prisoners in some cases had as many as 1,000. Some huts had a lavatory, but this had long ceased to function and the authorities had made no provision outside, so that conditions on the ground and in the huts themselves were appalling, especially when it is realized that starvation diarrhoea and dysentery were rife.

First of all we had to arrange for the burial of the dead. The dead were lying just where they had dropped around the camp. Several thousand more inside the huts were lying amongst the living because the living were too weak to get them out. In some cases the living had pulled up floorboards and put the dead beneath them. (During the time we were at Belsen a total of 23 000 people were buried.)

The second point was to arrange suitable feeding. (Large numbers were dying of over feeding at the hands of well meaning British soldiers.)

The third point was to get on with typhus control and as far as possible to dust all the huts too.

The fourth point was to get rid of the debris of all sorts now littering the camps - rags, rubbish, human excreta, etc.

Within 2 kilometres of the Horror Camp itself were the *Wehrmacht* barracks. The buildings in this area are modern and were occupied, at the time of our arrival, by *Wehrmacht* and Hungarian soldiers. A group of barrack buildings at the lower end of this camp housed internees, about 600 to a building of 150 capacity.

I went round this area on the 17th with the military commander of the camp and the S.M.G.O. from Second Army. We had managed, thanks to Brig. Hughes, to impress the fact that hospitalization was the first and most important consideration, the medical problem being by far the greatest one. I selected an area of the barracks as suitable for our purpose, mainly on account of the number of its canteens - one canteen to each group of four buildings. These canteens had admirable cooking facilities and two large dining halls which could be and were converted into wards. The buildings themselves would each accommodate 150 people. I afterwards got eleven of these canteens.

We also earmarked two other buildings which we thought would be suitable. One was a German military hospital and the other which we called the 'Round House' had been a German officers' mess and was a magnificent building. The German military hospital had about 650 patients at the time, but after Brig. Hughes inspected it on, I think, the 18th, they very rapidly had 1 300 there. Accommodation for German wounded was becoming very tight at this time, and so it had to be used but the brigadier promised to have this hospital cleared as soon as I wanted to take it over for internees. So far we had earmarked accommodation for approximately 10 000 and I thought that was good enough for a start. The war was still on in those days other prisoner-of-war and concentration camps were being found and the brigadier could not guarantee any immediate hope of help.

The next thing was to find the equipment for this hospital area. As we only carried 50 beds in the C.C.S. it all seemed rather hopeless at the beginning, but we began to look for equipment and soon found it in the barrack area. We found blankets, sheets, palliasses, feeding

and I cannot speak highly enough of their efforts under the guidance of Dr Meiklejohn

Six Red Cross relief teams did wonderful work, and, as time progressed, extra help was forthcoming from other sources, but the main brunt had fallen on army medical units of the R A M C throughout the early days. The first medical unit commenced work on April 17, the first admissions to hospital on April 21, the whole area cleansed by May 18, and during that time a hospital area of 14,000 beds equipped and fitted

I should like at this stage to pay a tribute to the work of Lt -Col J A D Johnston and Lt -Col F M Lipscomb, who were in charge of the administrative and medical side. The value of their efforts cannot be estimated

JUNE 1945

## GERMAN CONCENTRATION CAMPS EARLY MEASURES AT BELSEN

COLONEL J A D JOHNSTON, OBE, MC  
OC, 32 CCS

I first entered Belsen on April 17, with my unit 32 CCS No 11 Light Field Ambulance joined us there on the same day. There was already one field hygiene section there

My own first impressions of the camp were those of incredulity rather than horror. I just could not believe what I saw. But these feelings rapidly changed to an anger I have never experienced before, to a loathing of the SS men and women who had controlled the camp and of the entire German nation who had allowed *this thing to happen*

First, we had to get the sick out of the horror camp as soon as possible and get them into clean areas, and this had to be done with an organized plan of evacuation, reception and cleansing and delousing prior to admission into clean buildings. The second step would be to evacuate the fit likewise into clean buildings at the earliest possible moment with a similar plan of cleansing and delousing. In view of our limited resources and the time it would take to complete this task, the following urgent measures had to be carried out in the horror camp itself to prevent further loss of life from starvation or disease. It must be appreciated in this connection that conditions were absolutely ripe for an epidemic, and I knew from what the internee doctors had told me that there were already a certain number of cases of enteric and dysentery in the camp

As regards the so-called hospital area this had to be cleared of all existing equipment that was in it at the time, and we employed about 400 Hungarians on the job. Then the buildings had to be equipped.

We worked out two scales of equipment—Priority I and II. Priority I was the equipment necessary to allow us to start, viz. beds, blankets, sheets, feeding utensils, etc. Priority II was a little more elaborate and was added as the equipment became available. All my officers and N.C.O.s at this time were employed in acquiring equipment. We simply went in to local towns and villages and demanded equipment. Within a few days we had cleared and equipped two canteens and eight buildings. Reception was ready to function, the hospital store looked reasonably healthy and the ambulance cars were actually on their way to the Horror Camp when we discovered that the *Wehrmacht* who had left the previous night, had cut the water supply as a final gesture, and we had to stop everything for that day. We got started the following morning. We admitted only 300 that day but an average of 670 a day after that until we had filled that area.

The staffing of the hospital area was done in the first place by doctors and nurses who had been internees in the Horror Camp. These people were weak from starvation and practically all had only one interest in life and that was food and food they got at the expense of the patients. Consequently they had to be watched over, cajoled and bullied and I had to get rid of a large number of them. At this time I was only able to put one R.A.M.C. orderly to each building of 150 patients. We have in a C.C.S. only eight nursing sisters and these we employed in the particular square in which we were receiving. We got 670 people into an area a day and then as we moved on to the next square we left behind one nursing sister to supervise the squares of 670 beds. Two of my sisters went into the cookhouses and organized the cooking, etc. (these two women did the job extremely well).

We were now becoming very stretched indeed until help arrived in the shape of six B.R.C.S. teams, each team with eight women and four men. Of the women one is a trained nurse, one is a V.A.D. and the others do a certain amount of home nursing but they all became nurses in Belsen in fact they all became supervisors of Belsen in the end.

Then we got a hundred British medical students. When they arrived large numbers were still dying in the Horror Camp from starvation—the only way we could employ them was down in the Horror Camp and they did the job most magnificently and were undoubtedly responsible for saving several thousand lives. We also cleaned up an area of the Horror Camp—established a small human laundry and temporary hospital area, and there the students did the doctoring.

As regards hygiene, we had two field hygiene sections. One was employed purely on typhus control, working under the direction of

utensils, in fact all the thousand and one things required to organize such a job. My officers and men were sent out in search parties, as the Army was not in a position to help us much at this time, and they found sufficient stuff to equip about 3,000 beds. Why this stuff had not been used in the Belsen Camp I cannot state.

The *Wehrmacht* were still hanging about at this time and all sorts of rogues, including internees, were also on the scrounge so we had to put on our men to guard the equipment as it was found. In the barrack area there was quite a large number of stables and I earmarked one of these as a store for the equipment as we found it. To run this store I put in one of my anæsthetists – a man of many parts, and of a highly acquisitive character. When he moved in he took with him a large revolver which he undoubtedly needed.

The next thing to do was to arrange for some form of reception place where patients could be cleansed and deloused prior to their admission to the new hospital area. We used another stable for this purpose, got a section of a mobile bath unit to provide the hot water, staffed it with German nurses, and organized and arranged it so that as the patients arrived from the 'Horror Camp' they were placed on the tables, scrubbed from head to foot with hot water and soap, deloused and their heads were shaved if we thought it was necessary – everyone was lousy. They were then transferred on to clean stretchers, and into clean ambulance cars and so to wards. It is interesting to note here that out of 14,000 odd treated only two died during the process. It is also interesting to note that of the 46 German nurses we employed 23 developed typhus.

The next thing was food. When we first arrived hundreds were dying of starvation and large numbers were soon developing over-feeding diarrhoea at the hands of well-meaning British troops. One trouble was that the fit, or alleged fit, internees who could get to the cookhouse got all the food, and the thousands of sick or starved, who were too weak to walk, got nothing. So we put in a few men of No. 11 Light Field Ambulance and they provided milk for about 5,000 odd people who otherwise would not be fed. There were far more to be dealt with and we could only provide milk twice a day. We had enough tinned milk to keep us going but this was full milk and these people could not assimilate the fat. However, thanks to Colonel Sydenstricker and Dr. Leach, of the United States Medical Corps, who came up from Holland where they were working, we very rapidly had dried skimmed milk flown out from home plus advice on the feeding of these people. Colonel Lipscomb made out diet scales for the hospital area we were starting and for the 'Horror Camp.' In this connection we had to lay down the 'Belsen standard of fitness' – namely, anyone who could walk to the cookhouse for food.

We started a medical store and dispensary in one of the canteens of the hospital area.

to hospital, roughly about 8,000 cases. There was a distinction between two groups.

The first group showed extreme emaciation with lowering of bodily and mental processes, resulting in prostration, apathy and grossly impaired digestive function. The majority of these patients were also dehydrated, some very severely.

The second group showed oedema in addition to the features I have mentioned. It was gross in about 6% of the cases admitted but many more patients had minor degrees of oedema, which became pronounced when fluid was given to relieve dehydration.

Diarrhoea was a very common feature which sometimes aggravated the dehydration.

One of the secondary features of starvation was anaemia. Some of the starved patients showed little evidence of it but in others it was most pronounced depending probably on the blood concentration. The anaemia showed a nearly normal colour index and very little scatter in the size of the red cells.

An interesting point was the effect of heat on these cases of starvation. On two hot days when the temperature in the huts was about 95 patients who were improving to the extent of getting about collapsed.

Contrary to expectations clear-cut specific vitamin deficiency syndromes were absent: no scurvy, no definite beri-beri, no xerophthalmia. A harsh dry skin with follicular keratosis was often seen, but in the presence of the effects of dehydration, exposure, and scratching its precise cause was difficult to assess. In certain cases of diarrhoea a raw red painful tongue, often with marginal ulcers, skin pigmentation and mental changes suggested nicotinic acid deficiency but no case of classical pellagra was encountered.

The second most important disease was typhus which accounted for approximately 25% of the early admissions to hospital. It presented the usual clinical features. As far as could be ascertained none of the internees had been inoculated against it. Ten R.A.M.C. personnel, previously inoculated, contracted it while working in cleansing and delousing operations in the huts. In all these the fever lasted six to eight days only instead of the usual fourteen and all recovered. Twenty three German nurses contracted the disease and it ran the usual fourteen days' fever. Two of these nurses died but the difference in case mortality is not significant.

Operations for the delousing of the whole population were completed on April 30 and quarantine was lifted on May 21.

The third most important disease was tuberculosis. Clinically advanced pulmonary tuberculosis was obvious in about 6% of admissions. Radiological examination of a cross section of 331 cases, unselected except that they were not too ill to be screened, showed



Capt Davis of the U S Typhus Control The other did nothing but sanitation

I then got another field ambulance. They came into the hospital area which had extended to 5,000 beds, and still at that time I could not spare more than one R A M C orderly for a building of 150. We then got part of a 600-bedded hospital and very shortly after they arrived we started to take over another area of the barracks. Finally a 1,200 bedded hospital came in and they began to take over from my unit and the field ambulance

The job has been a tough one but it undoubtedly has had its compensations, for now the improvements are most marked. Many still die from tuberculosis, the complications of typhus and the effects of starvation, but at least they will die comfortably

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## GERMAN CONCENTRATION CAMPS DISEASES ENCOUNTERED AT BELSEN

COLONEL F M LIPSCOMB, O B E , F.R.C.P.

*1/c Medical Division, 115 (Brit) General Hospital, B L A*

*Attached 32 C.C.S. as Medical Adviser to Senior Medical Officer, Belsen Concentration Camp*

I was attached to 32 C.C.S. six days after the unit entered Belsen on April 17

The nutrition of the internees prior to our arrival was somewhat as follows: their diet, at least since January, 1945, and probably longer, appears to have been about 300 gm of rye bread, some vegetable soup and varying amounts of a root vegetable resembling mangold wurzel - the total each day amounted to about 800 calories. Small quantities of meat arrived from time to time but these were consumed by the kitchen staffs and then friends. What each individual actually received depended mainly on his ability to obtain it, because persons who have been starved for any length of time become entirely selfish and take all the food they can get irrespective of the other people's needs. Finally, the great majority of the internees had received no food or water for some five days before the camp was uncovered.

There were many diseases present in the camp besides starvation

There were three conditions outstanding above all else - deficiency disease, typhus, and pulmonary tuberculosis

First comes deficiency disease. All patients admitted were suffering from more or less malnutrition. This malnutrition was in an advanced stage and appeared to be the major disease in some 60% of admissions

of diarrhoea, and finally the degree of urgency a task to exercise the most experienced physician. In severe cases treatment required highly skilled nursing and possibly intravenous or intranasal therapy which at the outset was unobtainable for such numbers.

Later as more stores and staff became available it was possible to employ special measures. These measures included proteolysates by mouth, oesophageal tube and vein, and single and double strength plasma by vein, in all cases with glucose and vitamins. The results obtained by workers were very variable. Under these circumstances an opinion of their value was based on clinical impressions and has, I fear little real scientific worth.

The principle was laid down by Brigadier Glyn Hughes and Colonel Johnston that the greatest number of lives would be saved by placing those with a reasonable chance of survival under conditions where their own tendency to recover could be aided by simple nursing and feeding and by stopping further infection.

The distribution of food is of paramount importance and must be supervised by medical or nursing officers.

The great majority of cases of starvation that are likely to survive can take suitable nourishment by the mouth if it is fed to them properly.

A mixture of skimmed milk (2 litres) sugar 1 or 2 oz and water (1 or more litres according to dehydration) flavoured if possible in small frequent feeds, with three compound vitamin tablets, is satisfactory for each of the first few days. To begin straight off with solid food may be disastrous and even though patients cry for more food it is wise to increase the ration gradually.

Feeding by oesophageal tube of these often mentally deranged patients requires as much supervision as intravenous therapy and absorption from the gut, even of proteolysates, is uncertain.

The circulation of a starved individual is extremely sensitive to overloading, and it is there that the judgment of the physician on how much to give is important.

If a case of oedema is rightly assessed, intravenous plasma often gives striking benefit. An attempt to introduce theoretically sufficient nitrogen in the form of proteolysate needs so much fluid that it may exaggerate the oedema.

There are two other points I would like to mention here (1) German doctors used salyrgan for hunger oedema with dramatic immediate relief of oedema and consequent subjective improvement. Later results are not known. (2) Cancrum oris healed surprisingly well under treatment for nutritional defect and local applications of sulphonamide and penicillin powder leaving clean deformities for later plastic surgery.

In conclusion I would say that the types of disease resembled those seen among European refugees in Peru, except that among the latter about 40 % of admissions had malaria parasites in their blood.

12% positive and 8% possibly positive – say 16% radiologically positive. Adding 4% for the obvious cases too ill to be screened makes the total percentage somewhere about 20%. Dysentery was generally feared but proved to be less prevalent than had been expected. Both clinical and bacteriological examination of separate series of cases of diarrhoea showed that about 8% had bacillary dysentery – Flexner II being the prevailing organism.

Severe scabies was present in about 6% of admissions.

Sepsis was prevalent in many forms – sores, abscesses and neglected wounds – but pyococcal skin infections such as impetigo were surprisingly rare.

Other infectious diseases were absent or present only in smaller numbers such as one might expect in a normal population of this size.

To revert to diarrhoea which was a very common symptom and appeared to be due to a variety of causes. A small series treated with 300 mg nicotinamide daily for four days appeared to do slightly better than a control series with similar symptoms.

The majority of cases of diarrhoea seemed to be due to intolerance of the gastro-intestinal tract to increased food. A very large proportion of these cases cleared up in a few days after careful dieting but some were intractable.

Cases of actual psychosis, excluding infective toxic cases, and well-developed cases of psychoneurosis were less common than one would expect in an average community of the same size, probably because they had not survived the conditions in the camp.

Loss of normal moral standards and sense of responsibility for the welfare of others was widespread, in severe cases interest in others did not extend beyond child or parent, eventually the instinct to survive alone remained even to the extent of eating human flesh. These psychological changes were proportional to the degree of starvation. Even among the better nourished, however, sensibility to fear of death and cruelty was blunted by repeated exposure; this was especially noticeable in children.

Recovery of normal behaviour ran parallel with improvement of bodily health and was often surprisingly rapid, leaving only a feeling akin to that of having had a bad dream.

As to the treatment of starvation. It was very early apparent that the problem is one of great clinical complexity, with considerable biochemical and physiological difficulties. Such biochemical investigations as could be carried out showed findings of considerable variability, and these were hard to correlate with clinical features.

In any individual case, factors to be considered were not only the degree of starvation, but also the degree of dehydration, the myocardium and the peripheral circulation; the effect of the diet, the influence of infection, and the use of drugs.

system involvement such as occurs in pellagra had not been noted. Also, no instances of Korsakoff's psychosis or other syndromes which might be related to vitamin deficiency could be remembered. Careful inquiry into the existence of true prison psychoses brought only negative answers. Suicides or attempts to commit suicide had not been frequent and the doctors thought that the incidence of mental disease had been about what might be expected in a similar group living as ordinary citizens.

The outstanding thing the doctors had noted long before was the increasing inertia which overtook almost all prisoners in time. (Hospital workers were the exception to this.) New prisoners would attempt to keep up interest and activities but before long the inertia would overtake them. It was practically impossible to arouse interest and prisoners were of very little help about the camp. The inertia was evident at the time of the visit. At noontime on a pleasant day men were lying prone on the ground everywhere and practically none were moving about. Perhaps the state of nutrition contributed a large share in this state.

It was reported by the doctors that with the coming of the liberating Army before VE day the camp seemed to come to life rather suddenly and there was considerable elation for a short time. This was followed by a let down in spirits with increasing suspicion and anxiety for personal safety. Frequently when attempts were made to remove seriously ill patients from the prison hospital to our evacuation hospitals there would be terror and struggling because the patients thought that they might be taken away to be tortured to death as they claimed had happened to friends in the past.

JUNE 1945

## THE PREPARATION OF HYDROLYSATES

D P CUTHBERTSON M.D.

*Medical Research Council*

Interest in protein hydrolysates dates from 1913 when two Danish workers, Henriques and Andersen, observed that in the goat they could establish not only nitrogen equilibrium but even nitrogen retention when an enzymic digest of goat's flesh was administered by vein to a member of the same species. On the basis of this experiment interest was naturally aroused in the possibility of hydrolysing proteins and using them parenterally in place of intact protein by mouth or tube for therapeutic purposes. But it was not until about twenty-six years later that information reached us from America that nitrogen equilibrium had been established in man by this means. In 1939 Elman and

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## GERMAN CONCENTRATION CAMPS. PSYCHOLOGICAL ASPECTS OF THE CAMPS

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Two German concentration camps were visited soon after being liberated by Allied Armies. One was a Polish slave labor camp at Ohrdruf near Gotha and the other was the notorious camp at Dachau.

The Ohrdruf camp was visited about the middle of April 1945, the day after it was liberated. Unfortunately very little information could be obtained from inhabitants because of language difficulties and because very few prisoners remained. Near the entrance to the camp were about twenty bodies lying as if they had fallen after standing in line. It was observed that each body had a bullet hole in the back of the head. Not far away in a wooden shed were approximately fifty extremely emaciated bodies piled up like cord wool. They had not been dead over two to three days. On a hill near the camp were large burying pits and a pyre where charred torsos could be seen.

On May 13, 1945, five days after VE day, the concentration camp at Dachau was visited. Permission was obtained to enter the inner prison camp and visit the prison hospital. This camp, originally built for 6,000 people, contained between 30,000 and 40,000 prisoners at the time of the visit. It was learned that as the Allies advanced from both sides in Germany, Himmler would order prisoners from other camps to this area. A copy of the final order written by Himmler and dated April 14, 1945, was seen. Among other things it stated that no prisoners would be allowed to fall into enemy hands alive. The crematory with its four ovens still in use and the gas chamber were seen and there was no doubt about the function of either. Near-by were the large kennels where dogs had been kept and it was said that they were trained to attack men in striped suits.

In the inner prison hospital there were two doctors who had carried on valuable medical service during several years of confinement. One of these men from Yugoslavia spoke English very well and at one time had studied preventive medicine in the United States. It was observed that in the entire camp only the doctors and other hospital workers retained an interest in work and were active in a constructive way.

At the time of the visit there were about 800 cases of typhus and about 1,000 cases of tuberculosis. Malnutrition was a serious problem, deaths from this cause being frequent. In the preceding weeks there had been many cases of peripheral neuritis which the doctors attributed to vitamin deficiency. However, pellagra was rare and central nervous

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## THE VALUE OF HYDROLYSATES IN THE TREATMENT OF SEVERE STARVATION AT BELSEN

JANET VAUGHAN O.B.E. D.M. F.R.C.P.

*N.B. London Blood Supply Depot*

At the invitation of 21st Army Group the Medical Research Council sent a team to Europe at the end of April to study the value of hydrolysates in the treatment of starvation. I should like to pay a tribute to the help and encouragement the team received from the R.A.M.C. personnel with whom it came in contact – particularly to Major-General Sir Edward Phillips, D.M.S. 21st Army Group to Brig H. L. Glyn Hughes, A.D.M.S. 2nd Army and Lieut. Col. J. A. D. Johnston Commanding Medical Officer at Belsen. The world has heard a great deal of the horrors of Belsen – it has heard all too little of the gallantry of the handful of men and women who had the courage to tackle one of the most terrible and immense medical problems that has ever arisen. I shall always feel it was a high privilege to have seen what men and women of goodwill can accomplish in the face of almost unimaginable horror and difficulty.

The scientific problem was twofold (a) To determine whether hydrolysates were effective in the treatment of severe starvation (b) to determine whether their use was practical under field conditions. The answer to both questions was in the negative. The materials to be tested can be divided into two groups – one to be given by intravenous injection and one by mouth. The intravenous materials were (1) Amigen – an enzymic digest of casein (2) an acid digest of casein fortified by tryptophane (3) serum. The oral materials were (1) hydrolysate (2) spray-dried milk. All were given with glucose and added vitamins. Following the instructions provided for use in the treatment of starvation in Holland a dose of approximately 50 gm. of hydrolysate was given daily in a 2.5% solution in the case of the intravenous preparation for two days and on the third day 25 gm. of hydrolysate was given in the morning followed by 60 gm. of milk powder in the afternoon. Patients on oral hydrolysate received 50 gm. hydrolysate for two days and 25 gm. on the third day followed by 60 gm. milk powder. Patients on milk alone received 120 gm. milk powder daily for three days. On this dosage patients were in negative nitrogen balance and in later observations a higher dosage of oral material was given.

Laboratory facilities in a German hospital were fair. Hospital facilities were primitive. It was impossible for the medical staff to

his collaborators made observations which were the forerunners of a large spate of subsequent investigations on man

In Henriques' and Andersen's experiments it was found that when the intake contained no nitrogen and was composed solely of glucose there was a definite negative balance, but as soon as an adequate intake of nitrogen was administered by vein in the form of amino-acids a definite positive nitrogen balance was obtained. The enzymic digestion used was such as to cause a breakdown of the proteins of the meat to polypeptides, and amino-acids. It is of interest that with this particular line of therapy the amount of nitrogen in the faeces was quite small - 0.1 gm - probably representing the residual secretions of the alimentary canal. The digest used by Elman in 1939 was an acid one and the degree of hydrolysis was such that the protein was split practically completely to amino-acids. In securing this degree of hydrolysis, however, with acid some of the tryptophane is lost, and has to be restored to the solution, generally by adding pure dl-tryptophane. The next stage was that Cox and Mueller administered to patients a digest of casein induced by the proteolytic enzymes of the pancreas. This 'tryptic' digestion breaks down the proteins to lower peptides and amino-acids. One of the great difficulties in producing a digestion with the proteolytic enzymes of the pancreas is that the optimal temperature for splitting is just that which permits the growth of micro-organisms, and it is difficult to keep down bacterial growth during the digestive process. Unfortunately a large proportion of the pyrogens which have been formed by the micro-organisms pass through the filters that are at present available, and so the clinician tends to get frequent pyrogenic reactions with these enzymic preparations of proteins. Because of the temperature of the hydrolysis and the strong acidity, acid digests are normally free from bacterial growth.

In considering enzymes suitable for this work much attention has been paid to papain because its optimal temperature, 50 to 60° C., inhibits the growth of bacteria, and in the course of twenty-four hours or so it can produce a 25% hydrolysis of protein. Unfortunately, it is not ultimately so efficient as 'trypsin' for the peptidases in the latter cause a more complete breakdown of the protein. Papain digests of meat have, however, been used in India in the treatment of the starving destitutes of the Bengal famine and with reported success. It has been utilized also as a preliminary stage in the further hydrolysis of protein by 'trypsin'.

There is one point which it is pertinent to consider when reviewing the treatment of cases of inanition. Elman showed that in dogs there is apparently a constant relationship - no loss or gain - between plasma-albumin and the total body protein, the ratio being of the order 1:30. Thus for every gramme of increase of plasma-albumin desired, about 30 gm of protein must be retained for increases in other proteins of the body. A reduction of plasma-albumin from, say, 4 gm.

There was loss of oedema and an increase in general strength and well being.

An attempt was made to treat seven patients with oral hydrolysate. This material has an extremely unpleasant and persistent taste. To obviate this it has been suggested that a stomach or nasal drip should be used. The Belsen patients, however, regarded the tube as a new form of torture, and only two were persuaded to take it. One died on the second day—the other at the end of two and a half days was definitely worse. The diarrhoea was more severe, the oedema was no better and he was more apathetic and difficult than he had been on admission. A third case took a double dose for two and a half days by mouth. The oedema of his face improved somewhat but the ascites and the oedema of his feet and legs did not. He was no stronger. A fourth case had oedema and ascites but no diarrhoea when first seen. The second day on a double dose of oral hydrolysate he passed half a bucket full of watery brown faeces containing on analysis large amounts of different amino-acids, he had severe colicky pain and increased ascites. He was therefore transferred to milk diet. Two further cases refused to take more than a small amount of hydrolysate and were given milk instead. Three patients received the glucose milk mixture given in frequent small feeds for three days and all did well. As long as flavouring with tea or coffee was available the milk was easy to administer and enjoyed by the patients. This is a point of some practical importance. The commonest deficiency present was a pellagra like lesion of the tongue, gums and buccal mucous membrane, resulting in a sore and dirty mouth. Frequent mouth washes were out of the question with the scanty nursing help available and milk alone is apt to become unpleasant under such circumstances.

Experience showed that the majority of patients were able and anxious to take fluids by mouth. At a guess less than 5% of the patients at Belsen needed intravenous therapy. Intravenous therapy is not ideal in the conditions under which the work was carried out (a) because the patients regarded it as a form of torture (b) because sterility was far from easy to maintain (c) venepuncture in the collapsed and dehydrated patient admitted from the laundry was difficult, requiring skilled personnel to perform it successfully while a drip needed constant care and attention which might be used to better purpose in nursing the patients.

If intravenous therapy was indicated the results with serum were more promising than those obtained with hydrolysates. This may be due to the fact that to avoid reactions hydrolysates must be given in weak solution and it is therefore not possible to give more than a limited amount of protein without giving too much fluid. It is, however, possible to give relatively large amounts of concentrated protein in the form of serum or plasma.



previously, and were in a position to give a certain measure of advice on the materials to be put into the packs. With the help of the Ministry of Food and the Ministry of Supply and the collaboration of all the firms concerned, steps were taken to prepare the necessary units for oral and intravenous treatment. The intravenous unit for three treatments consisted of the following materials -

Instructions and record cards  
 5% acid hydrolysate, 10 bottles  
 Glucose-vitamin mixture, 1 tin  
 Plasma or serum, dried, 5 bottles  
 10% glucose in pyrogen-free water, 5 bottles  
 Giving sets, 4

The suggested scheme of treatment for those too ill to take food by mouth consisted of giving either glucose-vitamin by gavage in advance of - and again after - the administration of protein hydrolysate by vein or in giving plasma or serum with glucose. In this manner 50 gm of hydrolysate or approximately its equivalent of plasma or serum protein, together with 150 gm of glucose were to be given each day for the first two and a half days, by the middle of the third day it was thought that the patients might be going on to dried skim milk and glucose in water or condensed milk diluted. It was also decided that there should be set up sufficient material to test out on a similar scale the protein hydrolysates (an enzymic digest of casein or beef) for oral use. The oral unit for 16 complete treatments was as follows -

Instructions and record cards  
 Protein hydrolysate (enzymic), 1 tin  
 Glucose-vitamin mixture, 3 tins.  
 Skim milk, 20 tins  
 Bottles and giving sets, 4  
 Petroleum jelly, nails, adhesive tape and three measure scoops.

It was fully realized that little exact knowledge existed at this stage concerning the treatment of starvation and it was appreciated that we might require to make drastic alterations in our proposed line of approach to the problem. As Dr. Vaughan and Dr. Loutit will disclose, this proved to be the case, for shortly after the material was prepared for the Netherlands, the Medical Research Council were also invited to send out a small team to investigate the best method of treating our own prisoners-of-war, who were then being liberated from prison camps in Germany. This team was sent to Belsen Concentration Camp and there undertook work of which this Conference will now hear an account from Dr. Janet Vaughan, its director.

vitaminized dextrose were much more useful, such mixtures could be fed in almost unlimited amounts and were eagerly accepted. It was possible to feed even very ill patients quantities of milk-dextrose mixture which furnished 2,500 to 3,000 calories per day and supplied 200 to 250 gm. of protein. The Dutch physicians seemed quite agreed that skim milk powder and dextrose constituted the feeding mixture of choice for the treatment of starvation and famine edema.

In closing I must pay tribute to the work of the 32nd C.C.S. at Belsen. Never have I been so impressed by the skill, efficiency, versatility and whole-hearted devotion of any group. There must be special praise for Colonel Johnston, the officer commanding this unit.

JUNE 1945

## CONDITIONS IN PRISONER OF WAR CAMPS AND HOSPITALS IN GERMANY

LIEUTENANT-COLONEL HERBERT POLLACK, M.C. U.S. ARMY

We did a preliminary survey very early in April in two of the German prisoner-of-war camps and in the famous German Heppenheim Hospital, in order to get some idea as to what the problems would be with these recovered prisoners.

We classified those in hospital into three groups -

### *Hospitalized Camps<sup>1</sup>*

*Group I* - (1) Moderate weight loss. (2) Weakness. (3) Gastro-intestinal distress.

*Group II* - (1) Marked weight loss. (2) Weakness. (3) Evidence of specific deficiencies (edema, glossitis, neuritis etc.)

*Group III* - (1) Extreme weight loss. (2) Marked weakness. (3) Dyspnea on least exertion. (4) Nausea and vomiting. (5) Delirium or coma.

It was obvious that those patients who would be evacuated through medical channels would present no difficulties.

The big problem was going to be with the 80% going back through non-medical channels. The gastritis and gastro-intestinal upsets, brought about by soldiers giving the prisoners their rations, caused a great deal of trouble and a directive was issued on this subject.

The main deficiency has been calories and next important, protein deficiency. The order of frequency of observed deficiencies has been. (1) Total calories. (2) Protein. (3) Vitamin A. (4) Thiamin (5) Niacin. (6) Riboflavin.

No evidence of scurvy was seen at any time.

<sup>1</sup> Recovered Allied Military Personnel.

communicate with the majority of patients because of language difficulties. Patients who were brought into the ward where there was inevitably some apparatus about shouted 'nicht crematorium'. If a syringe was used to collect samples or an attempt made to set up an intravenous drip they again shrieked 'nicht crematorium' and curled up shaking in the bed. It had been the habit in the camp for the doctors to inject people with benzine or petrol when alive to induce a temporary paralysis so that they could be taken to the crematorium as dead.

Patients were selected from the daily admissions to the 'human laundry' or from the wards. Men who were so weak that they had to be lifted from the stretchers on to the slab, who were grossly emaciated or else had generalized famine oedema, and as far as could be judged had neither typhus nor tuberculosis, were chosen. Oedema of the feet was almost always present, and diarrhoea was extremely common, often so severe as to lead to incontinence. It was impossible with the facilities available to culture more than a random sample of faeces; the majority of cultures proved negative. The initial plasma protein figures were low on all the patients examined - the mean on 10 patients with generalized oedema was  $3.84 \pm 0.93$  compared with a mean of  $4.99 \pm 0.78$  on the group without gross oedema. The mean figure for albumen on the oedematous group was  $2.09 \pm 0.46$  compared with a figure of  $2.79 \pm 0.43$  on the non-oedematous. In only one instance was there a gross disturbance of ratio.

Hæmoglobin figures in the men were surprisingly high. The estimations were made with a Sahli instrument which has not yet been standardized. The mean figure for 21 men was 66.5%. This includes three low figures of 27%, 30% and 38% and one high figure in a collapsed dehydrated patient of 128%. Excluding these four figures the mean was 69.0%<sup>1</sup>.

### RESULTS

Five patients were given amigen by the intravenous route. Four did well, the fifth - a patient with famine oedema - showed no improvement.

Three patients were given acid hydrolysate by the intravenous route. Two showed slight, if any, improvement and one - a patient with gross oedema and ascites - became much worse. His abdomen became grossly distended and he developed moist sounds all over his chest. He was then given two litres of concentrated serum over a twenty-four-hour period with the hope of raising his serum proteins. The ascites was considerably reduced and his general condition improved. Three patients showed great improvement on serum, two were given serum in normal concentrations and one 2 × concentration.

<sup>1</sup> These figures will need slight correction when the acid used has been standardized. It will not affect their relative value.

men had in this camp with these diarrheal episodes. The first group of patients were hospitalized for nutritional edema, neuropathies, paresthesias and hyperaesthesias. In the cases of extreme weight loss and total emaciation, patients were unable to walk from the bed to the latrine—they were just bedridden people. On the basis of these observations, we classified them as malnutrition, where caloric intake had been sufficient to maintain life but not sufficient to maintain a normal metabolic level. The starvation seen in these groups is entirely different from chronic malnutrition which leads to emaciation.

Therapeutically we found, as Brigadier Bulmer has expressed so ably before, that it is a question of giving a bland diet, which can be tolerated, rather than going into any rehabilitation or nutritional programs. We give powdered milk suspensions, using a 14 : 1 dilution, instead of the usual 7 : 1 until the nausea and anorexia has disappeared. A soft diet given as early as possible has done more toward getting them back into circulation than any other therapeutic measure that we have given them. This is the experience of a daily sick call in one of the RAMP<sup>1</sup> camps, before the introduction of the soft diet.

*Comparison of Daily Sick Call at Ramp<sup>1</sup> Camp Before and After  
Introduction of Bland Diet*

<i>Before</i>	<i>After</i>
(1) Acute gastro enteritis (80%)	(1) Acute upper respiratory infection.
(2) Acute upper respiratory infection.	(2) Diarrhea (15%)
(3) Pyoderma.	(3) Cellulitis.
(4) Edema.	(4) Edema.
(5) Polyneuropathies.	(5) Hepatitis.
	(No nausea and vomiting for 1 week.)
(Rate—20% daily)	(Rate—4% daily)

Of all soldiers at morning sick call, 80% had as a presenting complaint acute gastro-enteritis. After introduction of bland diet, the nausea and vomiting disappeared in this camp (which had at least 8000 RAMPs<sup>1</sup>). The diarrhea persisted in a small percentage of patients but the gastro-intestinal picture changed completely. The sick call rate dropped from 20% of the daily population to 4%. We find that the sick call rate has dropped even lower than that now.

A question that has been raised is to what this diarrhea and gastro-enteritis is due. From the medical service at the 217th General Hospital we have been able to get X ray studies on these people. The X ray studies show characteristic segmentation, puddling stasis and gas—the picture that one sees in the sprue syndrome associated with vitamin B

<sup>1</sup>Recovered Allied Military Personnel.

Oral hydrolysates in our hands gave uniformly bad results (a) It was difficult to persuade the patients to take it because of its unpleasant flavour, (b) it appeared to irritate the gastro-intestinal tract On the other hand the results with skimmed milk were extremely satisfactory

In making this somewhat dogmatic statement it is realized that a peculiar type of patient was being treated, one who had been starved, dehydrated and possibly tortured for a long period, who suffered from many intercurrent infections and profoundly unhygienic living conditions Hydrolysates may prove more successful under different circumstances

JUNE 1945

## HYDROLYSATES IN THE TREATMENT OF STARVATION IN HOLLAND

COLONEL V P SYDENSTRICKER

*U.S. Public Health Service*

It was my good fortune to be able to do some work in Holland and also to visit Belsen I can corroborate what has been said regarding the use of protein hydrolysates in the treatment of starvation

Early in April my group was asked to try out the hydrolysate and vitaminized dextrose mixtures in a place occupied by a large number of elderly insane persons in an advanced state of starvation Many had famine edema While very bad, the condition of these patients was not comparable with that of the inmates of Belsen

Perhaps because they were insane, those people drank the hydrolysate and dextrose solutions without complaint, many of them liked the mixture but their hunger was not satisfied by it, they asked for solid food Clinical improvement during hydrolysate therapy was satisfactory when amounts equivalent to 100 or more grammes of protein a day could be administered Mixtures of reconstituted dehydrated skim milk and the vitaminized dextrose of equal protein and caloric content with the hydrolysate-dextrose solutions were better taken and had an equally rapid curative effect on famine edema There was no evidence that the hydrolysates of protein were more readily utilized by starving people than the whole proteins of milk

In the famine areas of Western Holland hydrolysate therapy was disappointing Oral administration of the solution usually was successful for about twenty-four hours, then the taste of the mixture became so disgusting that patients refused to drink it Administration by indwelling gastric tube proved to be quite impracticable Intravenous therapy was a failure because adequate amounts of the solution could not be administered Mixtures of reconstituted dried skim milk and

JUNE 1945

## RECOVERED ALLIED MILITARY PERSONNEL THE PROBLEM OF TUBERCULOSIS

LIEUTENANT-COLONEL THEODORE L. BADGER, M.C. U.S. ARMY

*Senior Consultant in Tuberculosis*

The problem of tuberculosis in recovered prisoners-of-war was studied in the general hospitals of Eastern France where they were received in large numbers. The 46th General Hospital which received most of the recovered soldiers presented an incredible picture of tuberculosis and starvation. These men, largely Russians, were living skeletons though still able to walk. They spoke no English and knew no discipline. They had been for the most part captured in 1941 in the Black Sea area and the Ukraine. They had been marched across Germany and eventually placed in the mines and heavy industries of the Ruhr where they were recaptured and hospitalized in U.S. units. Before capture they were regarded as being in good physical condition and are said by Russian medical officers to have been X-rayed before induction into military service.

Treatment was directed first toward the care of malnutrition, then the arrest of the tuberculosis. Collapse therapy was conservatively used, especially pneumothorax, as the multiplicity of adhesions showed poor collapse, and the widespread bilateral disease with extensive tracheobronchitis was not considered suitable for collapse therapy in the acute stage.

Pathologically the tuberculosis was of a chronic fibrocaceous type, widespread with extensive cavitation, with extensive lymph-gland involvement in both chest and abdomen and with highly positive sputum. But, in addition, there was much diffuse necrosis without tubercle formation, giant cells, epithelioid formation or interstitial cellular reaction. Pleural adhesions were multiple and often obliterative, giving evidence of chronicity. Military tuberculosis was conspicuous for its rarity though evidence of sporadic hematogenous spread was apparent from the involvement of many organs of the body especially the liver and spleen. Lymph-gland involvement and necrosis were often extensive and indicative of either overwhelming infection or of greatly reduced constitutional resistance. The absence of fibrosis in many cases was a striking feature of the pathology.

Routine X-rays of all hospital admissions to the 77th Field Hospital revealed the following figures

I was able to obtain the official documents of the German Army issue to a group of several hundred P o W s who were marched many hundred miles in eighty-two days from Upper Silesia to Southern Germany. The nominal number of calories per day was 852, but actually it was about 620, because about one-third of the food offered was completely inedible (*see Table*)

#### AVERAGE DAILY RATION ISSUE DURING AN 82 DAY PERIOD

Food item	Grams per man		Pro- tein		Cal- cium		Vitamin		C	G
	per day	Calo- ries	(gm)	(gm)	(mg)	(mg)	A (1 u)	B (mg)	Niacin (mg)	(mg)
Bread	191	561	13	4.4	90	6.00	—	—	—	—
Meat	13.8	17	1.9	1.0	1	0.42	4	0.010	0.56	0.028
Potatoes, Dhy.	45	144	3.6	0.2	19	0.23	—	0.063	1.80	0.063
Margarine	3.7	31	—	3.4	—	—	—	—	—	—
Grain Products	18.3	63	1.8	0.2	3	0.04	—	0.022	0.34	0.007
Sugar	6.6	28	—	—	—	—	—	—	—	—
Jam	1.8	5	—	—	—	—	—	—	—	—
Vegetables, asstd	8.5	3	0.1	—	3	0.05	54	0.005	0.05	0.005
Cheese	0.6	—	—	—	—	—	—	—	—	—
Total	289.3	852	20.4	9.2	116	6.74	58	0.100	2.75	0.103

It represents the average daily issue to one man, based on the feeding of several hundred people in an eighty-two day march. These people marched for eighty-two days and had an average caloric issue of 620 calories. The protein intake during this march averaged 20 gm a day, thiamine 0.1 mg, riboflavin 0.07 mg, vitamin C 3 mg, nicotinic acid 3 mg. On the march they used potato flour and dehydrated potatoes, which are not usually given in fixed camps. This is not one of the worst ration issues. It is an average one during one march period. We have seen instances of the ration issue being as low as 600 calories and others where the issue was up to 1,700 at one time.

In the fixed camps the average caloric intake is 800-900 calories per day. The British and Americans very often gave their regular ration to Russians and Poles because they could subsist on the Red Cross parcels. The tragic starvation of these men who were going to be sent up through non-medical and medical channels presented an important problem. 95% should have been in medical channels, but administratively this was impossible and so criteria for hospitalization were set up, starting with the men who really need hospitalization urgently and those who can be evacuated.

The presenting symptoms were weakness and gastro-intestinal distress. One man (Limburg, Stalag XIIA), describing the bouts of diarrhea, said that when the attack came on he did not have time to take off his trousers and so he walked about in a blanket. This is by way of illustrating the extreme urgency and the difficulties which these

previous experience had led us to expect. But a longer period of imprisonment might well have found these troops in the same serious condition from tuberculosis as those Allied troops freed after three or more years in German hands.

In these large groups of recovered nationals, the problem that confronts us is one of the future. Their intensely active disease may become widespread in uninfected populations unless segregation of the tuberculous can be established and maintained while infectivity remains. These people are a post war problem in prevention and control of tuberculosis and they are foci for the spread of the disease.

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complex deficiency This X-ray picture of the clinical syndrome improves rapidly with proper therapy

It was quite apparent that the severe cases do not tolerate vigorous intravenous therapy It frequently leads to pulmonary edema, cardiac and renal failure and death and certainly to severe vasomotor and other secretions On the other hand, the gastro-enteritis may prevent oral therapy The question was answered by using plasma in those patients who could tolerate it, to the extent of 250 c c for the first twelve to twenty-four hours, given at a rate of less than 2 c c a minute, if possible No more than two units of plasma (500 c c) or 500 c c of fresh blood should be administered in twenty-four hours Thiamin 30 mg and niacin 500 mg is administered parenterally at twenty-four hour intervals

Mild reactions are still quite common with this form of intravenous therapy These people are really just a hibernating mass of protoplasm, they weigh in some cases a mere 50 to 60 pounds The amount of active metabolic tissue they have left is very small The bulk of their weight is metabolically inactive skeletal tissue Furthermore, their caloric requirements are very small With such low caloric requirements their vitamin requirements are also very low, particularly with respect to the B complex Normal thiamine requirement per day is 2 mg, but their thiamine requirement is probably 0.2 mg Avitaminosis, as we see it in the States, does not exist in these people Under therapy, these dehydrated, dried-up people develop edema, which then disappears in the course of time as the metabolic state is brought back to normal It is largely a problem of nutritive rehabilitation, and it is during this rehabilitation that edema shows up Plasma proteins were seen as low as 2.2 gm % in extremely dehydrated people Their skin is dry and cold, their pulse is slow The tongue is sometimes deeply scarlet The blood-pressure registers 60 to 70 systolic and 40 diastolic The moment one speaks to them while feeling their pulse it jumps up There is no cardiac reserve at all and hence intravenous therapy will frequently result in death We have had one or two unfortunate experiences in our own general hospitals in this respect

The complications such as the febrile states and infections respond to penicillin therapy We do not like to use the sulfonamide drugs in these people because of extreme dehydration Folliculosis is universal; whether this is due to the lack of vitamin A or because hygiene had broken down is not known

Advice generally as to therapy is to go as slowly as possible, not to attempt to restore too quickly because physiologic balance is too precarious

## SECTION XIII

### Progress in War Medicine Since 1939

*Final Conference on July 9, 1945*

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	<i>Number</i>	<i>%</i>
Total X-rayed	2,750	
Pathology present	149	5.41
Atypical pneumonia	64	2.32
Lobar pneumonia	13	0.47
Pulmonary tuberculosis (active)	12	0.44
Minimal	6	
Mod adv	6	
Pleural effusion	9	0.32
Total active tuberculosis	21	0.76
Tuberculosis Apparently healed	4	0.14
Miscellaneous	47	1.71

## COMPARATIVE STUDY OF TUBERCULOSIS

<i>Group</i>	<i>No X-rayed</i>	<i>Apparently healed</i>	<i>Active tuberculosis</i>	<i>Rate/1,000</i>
Allied Nationals	2,530	0	972	384.2
Amer Ramps*	2,750	4	21	7.6
Off Cand Sch'l	5,240	7	2	0.38
U.S troops 1943	7,243	91	7	0.90

\*Recovered Allied Military Personnel

It is too early to evaluate the influence of starvation on tuberculosis as seen in these men. Many unknown factors play a significant role in the high incidence in the Allied nationals. The rate in American Ramps of eight times that of the ground and air forces is more apparent than real and would appear to be dependent on three important aspects of tuberculosis.

The first is the liability of the individual to infection through contact. Our own troops were well screened by induction X-rays and a low rate of active disease in this theatre minimized the contact spread of tuberculosis. We know from soldier histories that the segregation of American troops from Allied nationals was usual. But in the marches from camp to camp across Germany we do not know how much gross contamination of living quarters had taken place by previous occupants with tuberculosis. Secondly, the constitutional factor and familial background of the individual was not known. Thirdly, the environmental factors, as seen in the extreme degrees of deficiency states, was important.

None of these three influences can be isolated as a single cause of the high tuberculosis rate in American Ramps, but all three are undoubtedly significant with the Allied Ramps. In the American Army as a whole, including Ramps before capture by the Germans, intrinsic and extrinsic factors of tuberculosis were the same in both groups. Thus the influence of serious malnutrition on the course of tuberculous infection rather than its effect on manifest tuberculous disease concerns us in these recovered American troops. The answer cannot be given here but the depression of resistance to tuberculosis in severe starvation does not appear to be as rapid in its effect as

## THE UNITED STATES ARMY

COLONEL WILLIAM S. MIDDLETON M.C., U.S. ARMY

*Chief Consultant in Medicine, European Theater of Operations U.S. Army*

The chapter of military medicine presented to these conferences by the United States Army in the European theater of operations discloses for the first time in the history of warfare more surgical than medical casualties. Paradoxical as it may seem, in the wars of the past disease has exacted a higher toll of man power than has the trauma of conflict. It has, indeed, been a surgical war with us. In fact this experience may well prove unique among the world wide operations of our armed forces.

Nor is the major explanation for this advantage far to seek. The advances of preventive medicine have paid high dividends in the low morbidity among the preventable diseases. Less than 50 instances of typhoid fever occurred in an army of over three million. Of these only 2 died. Up to this time 8 American soldiers have acquired typhus fever without a single death. Interestingly the clinical course of the disease has been greatly ameliorated by protective vaccination in our forces.

Perhaps the most dramatic advance in preventive medicine is encountered in the protection of tetanus toxoid. Among the universally protected American soldiers a single instance of tetanus developed. He succumbed. By diabolical fate the Nazis afforded the perfect control. Only the Luftwaffe and certain paratroop elements received tetanus toxoid. Of the unprotected German prisoners of war hundreds developed tetanus and scores died in American hospitals. A hideous commentary on Nazi psychology and medicine.

Yellow fever vaccinations proved a boomerang in our hands. The Surgeon General of the United States Army reported 28 585 instances of postvaccinal jaundice with 62 deaths in the first six months of 1942. Whatever may be the judgment of scientists and historians of the future, the capitalization upon this experience has greatly advanced the knowledge of hepatic disorders. Substantial support in correlating the clinical and the pathological findings has been derived from the studies of Dible, McMichael and Sherlock at Hammersmith. Now a virus etiology for the related if not identical, conditions, infective hepatitis, homologous serum jaundice and post-arsphenamine hepatitis, would seem established. The efforts of Stokes indicate the apparent prophylactic virtue of gamma globulin in this connection.

We were warned of the prevalence of virulent clinical diphtheria in



In World War I the mortality from meningococcal infections was 38%. In the European theater of operations the figure fell from 5.3% in 1942 to 2.8% in 1944. The diagnostic awareness of our medical officers and the prompt use of adequate doses of sulfadiazine account for this major therapeutic triumph. Penicillin has played an important but lesser role. Equally spectacular as its curative value is the prophylactic efficacy of sulfadiazine in this connection. Amounts as small as 2 gm. in a day will clear the upper respiratory passages of meningococci (A total of 7 gm. - 1 gm. three times a day for the first day and 1 gm. twice a day for the second and third days is recommended in this theater). Splendid as have been the results from the use of sulfonamides in bacterial pneumonias, by reason of its greater efficacy and the absence of toxic reactions penicillin bids fair to become the preferred antibacterial agent in pneumococcal pneumonia. Antisera have played no material role in meningococcal or pneumococcal infections in this theater. Bacillary dysentery has ever been a charge against the health and efficiency of military commands. With temporary lapses or failures in preventive measures bacillary dysentery has been a recurring but local problem in our forces. The earlier preference for sulfaguanidine and succinyl sulfathiazole gave way to sulfadiazine. Incidentally these sulfonamides proved more efficacious for the Flexner and Shiga forms of bacillary dysentery than for the milder ones and antidysenteric serum was rarely employed. The chemoprophylaxis of bacillary dysentery was quite regular in the isolated instances studied (1 gm. of sulfadiazine twice a day for five days is prescribed).

The treatment of gonorrhea with sulfonamides had scarcely been stabilized, when penicillin proved more effective. A curative figure of over 90% is afforded when 200 000 units of penicillin are given in nine hours (four intramuscular injections of 50 000 each at three-hour intervals). Again, in the treatment of syphilis an increasing experience with intensive arseno-therapy had gained certain advantages. Always the danger of toxic reactions confronted us, but a background of early successes offered a reasonable assurance for the future. Then came the heartening announcement of the spirocheticidal action of penicillin. The final test of time has not been applied, but 98.6% of syphilitic subjects, treated with penicillin (2,400 000 units total - 60 intramuscular injections of 40 000 units each - in seven and a half days) in the sero-negative primary stage, were sero-negative at the end of six months. The results in secondary and late syphilis have been much less impressive and it is probable that combinations with arsenic, bismuth or mercury and iodides will be required to attain the optimal improvement at these stages of the disease.

In no field of medicine has there been more substantial growth than in psychiatry. With the background of the World War I experience and the advantage of psychiatric observations in other theaters in this



In World War I the mortality from meningococcal infections was 38%. In the European theater of operations the figure fell from 53% in 1942 to 28% in 1944. The diagnostic awareness of our medical officers and the prompt use of adequate doses of sulfadiazine account for this major therapeutic triumph. Penicillin has played an important but lesser role. Equally spectacular as its curative value is the prophylactic efficacy of sulfadiazine in this connection. Amounts as small as 2 gm. in a day will clear the upper respiratory passages of meningococci. (A total of 7 gm. - 1 gm. three times a day for the first day and 1 gm. twice a day for the second and third days is recommended in this theater.) Splendid as have been the results from the use of sulfonamides in bacterial pneumonias, by reason of its greater efficacy and the absence of toxic reactions penicillin bids fair to become the preferred antibacterial agent in pneumococcal pneumonia. Antisera have played no material role in meningococcal or pneumococcal infections in this theater. Bacillary dysentery has ever been a charge against the health and efficiency of military commands. With temporary lapses or failures in preventive measures bacillary dysentery has been a recurring but local problem in our forces. The earlier preference for sulfaguanidine and succinyl sulfathiazole gave way to sulfadiazine. Incidentally these sulfonamides proved more efficacious for the Flexner and Shiga forms of bacillary dysentery than for the milder ones and antidyenteric serum was rarely employed. The chemoprophylaxis of bacillary dysentery was quite regular in the isolated instances studied (1 gm. of sulfadiazine twice a day for five days is prescribed).

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the Low Countries and Scandinavia, and supplies of antitoxin five times the theoretical need were afforded us before D-day. No serious epidemic was encountered, but an interesting observation was made. At one time a single German prisoner of war camp of 20,000 reported more diphtheria than the entire United States Army in Europe. The spacing of immunes scarcely explains this discrepancy. With increased civilian contacts the incidence of diphtheria among our troops increased. While this situation has never constituted a numerical problem, we were recurrently reminded of the changing emphasis upon disease and its diagnosis by the too frequent appearance of diphtheritic complications. The new generation in medicine is not diphtheria-conscious.

We were spared serious epidemics such as confronted the American Expeditionary Forces in 1917-1919. Primary atypical pneumonia threatened to assume epidemic proportions in the Fall of 1942. Thereafter its curve of incidence exceeded bacterial pneumonia, but it never became a grave problem. In November 1943 an ominous situation confronted us in an explosive epidemic of virus A influenza. Fortunately it was an interpandemic episode, free from complications and mortality. Had it been the first wave of a true pandemic, the invasion of the Continent would have been handicapped by the second and complicated sequence.

Malaria is not indigenous to the northern area of France. However, we inherited a problem in the management of relapsing benign tertian malaria from the Mediterranean area. With the movement of troops, indirectly via England and directly to France, this condition became a major factor in the attrition of man-power. Suppressive therapy with atabrin, when faithfully pursued, met all of the requirements of the situation, but human nature, supported by idle rumor and even by command at times, conspired to render objective evaluation virtually impossible.

Surpassing though the triumph of preventive medicine has been in the recent campaigns, nothing can detract from the fine contributions of clinical medicine. Two therapeutic agents lent unusual impetus to this advance. The sulfonamides had established their place in the therapy of bacterial infections before the war. With the organization of a military medical service came the opportunity to extend the trial of the newer modifications of these agents in many directions. Withal perhaps the greatest advantage was the facility for consolidating the general experience. Without minimizing the credit due to the sulfonamides, the most monumental contribution of this period has been the clinical application of penicillin. Fleming's observations (1929) had been brought into clinical focus by Florey and his fellows (1939-41). Its widespread clinical utilization is still in its infancy. Yet thousands of lives have been spared and countless man-days saved through its beneficence.

fied by the blockade of Japanese occupied bases and islands caused a breakdown in the supply of food and medical stores. The combination of loss of man power from malnutrition and the failure to prevent disease was due to the bad hygiene of the enemy exacerbated by the blockade. This enabled the Army's assault forces in the areas thus affected, easily to defeat those half-starved diseased and demoralized Japanese who were still able to keep on their feet. In turn, it is unlikely that the Allied Army could have consolidated their gains in these pestilential areas unless strenuous efforts had been taken to improve hygiene-discipline by the education of the combatant officers in the meaning and operational value of preventive medicine. This introduces the point I wish to make in this paper namely that *the most important medical lesson learnt in this war is that executive and combatant officers must be taught that the enforcement of hygiene measures to preserve the health, morale and fighting efficiency of their troops is as important as any other military duty*.

It has also been learnt that all medical officers must heartily endorse this principle and constantly preach it. This is not such a difficult task because most doctors in spite of the disproportionate emphasis placed on clinical medicine, in contrast to preventive medicine, in the medical schools have intelligence enough to learn quickly that preventive medicine in warfare occupies first place.

The impotence of the best health service, if the administration has not been educated to understand the supreme importance of prompt preventive measures, is nowhere better illustrated than in the report of the Commission on the causes of the Bengal famine of 1943. The Commission concluded that the government were sufficiently forewarned to have prevented the famine with its resulting epidemics, by controlling the price and distribution of rice, but that they failed to take action in time.

It is noteworthy that the number killed in Bengal by preventable disease in one year was five times the 300 000 killed by high explosive in the armies of the British Empire during five years of war. Nevertheless, the medical administrators of the fighting services are in no position to throw the first stone at those responsible for the Bengal holocaust because the ratio of preventable diseases to battle casualties in the earlier phases of the Japanese war has exceeded 100 : 1 in some theatres of operations. The final success of the R.A.M.C. in replacing the combatant officers' early indifference and apathy and gaining their enthusiastic support for hygiene, is to me the most remarkable achievement in the history of military hygiene.

Educating combatant officers to take hygiene seriously and the inculcation of malaria and hygiene-discipline in sailors and soldiers, is the most important duty of medical officers in war and peace. The problem is largely psychological as was so well illustrated by the story of suppressive atabrin. Many of us imagined that we had only to say

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years, but largely because there was a rumour that oxygen was a deadly poison if improperly used, and because submariners were not being adequately instructed in the elementary physiology of respiration, or in the technical use of their oxygen equipment, the instructions concerning the use of this safety equipment, which were based on comprehensive researches of many years standing had been ignored. Some submarine captains owing to their lack of confidence in their ability to use the oxygen apparatus, and the rumour that if they made a mistake in using it they were liable to be poisoned preferred the risk of suffocating on the sea bottom rather than take a chance of oxygen poisoning. Expert observers have now corrected all this, and designed better and more foolproof oxygen equipment.

The parallel between the reluctance to use oxygen and the reluctance to use mepacrine is striking. In both cases the use of these valuable means of preserving life and health were frustrated by false rumours combined with inadequate instruction of executive combatant officers in their rational and practical application.

The chief function of the Habitability Committee is to collect data, which will prove to the satisfaction of the medical and executive authorities, that the fighting strength of a ship depends as much on the fitness of her ship's company as on the fire-power of her armament and that nothing will be gained by piling in extra weapons if the living conditions are made so bad thereby that the morale and physical condition of the men suffer. Short and long term experimental work has been undertaken, therefore, with the object of defining the limits of habitability in which a man can remain 100 / fit.

In this work numerous data concerning the temperature, humidity, movement, and bacterial content of the ship's atmosphere have to be collected under all conditions of naval service. Indices of fitness have to be devised. As examples of such indices we may cite the rate at which men can perform gun-loading drill, or the rate and number of mistakes made in transmitting signals, under different environmental conditions, both before, during and after various periods of residence in bad climates. The question to be answered is this - will it promote fighting efficiency to reduce the number of guns and number of men needed to man them if the space and weight thus saved is employed in reducing overcrowding and in improving the accommodation of the ship's company by the installation of air-conditioning plant, laundries, and other amenities. Can it be proved that a smaller but fitter crew will find and hit the target more rapidly more often, and go on doing so for longer periods than a larger ship's company who though manning a heavier armament are exhausted by living under bad conditions and having to fight in an environment where their accuracy and rate of fire is liable to be seriously impaired? The problem to be solved by research and experiment may be briefly stated thus: *What is the ratio*

war a studied attack upon the problem was planned in the European theater of operations. During the period of training in Great Britain all medical officers with tactical troops in the First Army attended special courses in psychiatric first aid. The divisional psychiatrists were given longer training. Most constructive was the design for indoctrinating line officers in the mechanism and recognition of combat exhaustion. The dividends in the conservation of man-power from this planned approach were inestimable. Many of its features were taken from the Mediterranean experience. Hence, the Seventh Army brought its completely evolved program of management to the European theater. The rapidly changing tactical situation afforded less opportunity for such planning in the other armies, but in general the same pattern was followed. Psychiatric first aid at divisional levels saved many men to combat units. Then the combat exhaustion centers of the army acted as a further filter. Special hospitals for psychiatric care in the zone of communications salvaged an added number who might still render some measure of effective service, usually not in combat. At all of these levels the conservation of man-power was a prime objective. To this end military psychiatry simply brought to bear upon the military problem the concerted batteries of civilian psychiatric procedures.

At first glance, as we review the medical progress of the past three years in the European theater of operations, we are struck by the tempo of its evolution. Upon dispassionate analysis it becomes apparent that most of this advantage has resulted from a sharp acceleration of scientific developments. Many of the basic facts and discoveries antedate the war. Their rapid fruition is, in most instances, the result of superb teamwork. When we take into civilian life and practice the medical lessons of World War II, let us remember: "There never was a good war nor a bad peace."

JULY 1945

## THE ROYAL NAVY

SURGEON VICE-ADMIRAL SIR SHELDON DUDLEY, K.C.B., F.R.S.

*Medical Director-General of the Royal Navy*

It has had to be re-learned in many wars that the preservation of bodily and mental health is as important as are guns in the winning of battles. The relative weight of the two factors will vary with time and circumstance. In Western Europe weapons were probably more important than hygiene. East of Suez hygiene is probably more important than gunnery. But everywhere both factors play their part and are inseparable as a cause of victory. In the Far East, sea-power, as exempli-

years, but largely because there was a rumour that oxygen was a deadly poison if improperly used and because submariners were not being adequately instructed in the elementary physiology of respiration or in the technical use of their oxygen equipment, the instructions concerning the use of this safety equipment, which were based on comprehensive researches of many years standing had been ignored. Some submarine captains, owing to their lack of confidence in their ability to use the oxygen apparatus and the rumour that if they made a mistake in using it they were liable to be poisoned preferred the risk of suffocating on the sea bottom rather than take a chance of oxygen poisoning. Expert observers have now corrected all this, and designed better and more foolproof oxygen equipment.

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'a tablet a day keeps the fever away' and everyone would rush to get his tablet. Few realized how ignorance, apathy, suspicion, and even active hostility, would render the effect of such instructions almost valueless.

Naval experience in this war has taught us the lesson, that there is little use in supplying equipment for safeguarding health and security unless care is taken to ensure that the personnel who employ this equipment appreciate its value and know how to use it. Moreover, frequent inspections by experts are essential to ensure that any apparatus of the above nature is properly understood, employed, and efficiently maintained.

At sea our greatest hygienic problems are concerned with living conditions in ships, i.e. habitability. A 'Naval Habitability Sub-Committee' has been and is studying the means of making life more tolerable in warships exposed to extremes of climate in the Arctic or the Tropics. The baneful effect of ship-life in the tropics during this war rather took the Navy by surprise, because, in peacetime, life was quite tolerable in the tropics, when ships' companies were no larger than the ships were designed for, ventilation efficient, and when it was possible to make cruises to cooler parts of the Station during the hot season, and to arrange for plenty of leave and recreation. But in war, the picture became very different. More and more guns and gadgets were piled into the ships, and this extra machinery encroached on the living spaces of the ship's company. More and more men had to be crammed somewhere into the reduced space in order to man the extra guns and gadgets, until some ships contained 50% more men than the living spaces in the ship had been designed for, even before these spaces had been grossly reduced by the introduction of the extra machinery. The mechanical ventilation became inadequate. Natural ventilation was practically impossible owing to the black-out. Opportunities for leave and recreation became few and far between. To all this was added the fact that the naval population in peacetime had been a highly selected body of adventurous volunteers, who had joined the Navy to see the world. Moreover, in peacetime any man who exhibited the slightest degree of mental or physical inadaptability to the sea environment was immediately invalided, as suitable replacements were then in unlimited supply. In war, however, the character of the population completely changed. The Royal Navy is now chiefly composed of citizen conscripts, many of whom are below the physical standard accepted in peace, and most of whom desire, before anything else, to return to their homes and families. Moreover, as man-power became more and more scarce, every effort had to be made to retain at duty those who were really neither mentally nor physically suitable for service abroad in the tropics.

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## MEDICAL LESSONS FROM THE ASSAM BURMA CAMPAIGN

BRIGADIER H. L. MARRIOTT A.M.S.

*Consulting Physician, Allied Land Forces, South East Asia Command formerly Consulting Physician, India Command*

My experience has been chiefly in the tropics, and mainly in the India Burma theatre, where I have been Consulting Physician for three years first to India Command and then to South East Asia Command. Therefore I propose to deal with the lessons which have emerged from the three years' struggle which has gone on in that theatre. Many people do not realize what a big war has been waged there. The troops in the combat zone – most of them in combat – have numbered always somewhere between half a million and a million men, and there have been one and a half millions in reserve in India.

There we have learned many lessons in preventive medicine. Certainly we have learned more than the Japs, whose medical arrangements are not nearly as good as ours, and we have learned more than the Germans. I have just come back from a three weeks' tour in Germany to see if they have discovered anything especially in tropical medicine, and they have not.

In war in the tropics medical considerations dominate operations for two reasons: (1) the prevalence of disease, which causes the most colossal waste of man power, and (2) men in the tropics, quite apart from disease, are under exceptional mental and physical strain owing to climatic and general conditions, and the problem of maintaining them not only free from disease but fighting fit is a very difficult one.

We have no reliable figures for 1942 because our conditions were disorganized, but in 1943 the admission rate to hospitals for the year was 1,200 per thousand and the ratio of casualties from sickness to casualties from wounds was 121 to 1. In 1944 the hospital admission rate was just under 1,000 per thousand and the ratio of casualties from sickness to battle casualties was 19 to 1.

This time last year I was privileged to make a ten days' man-by-man survey of the 7th Indian Division who had just come out of action after ten months' hard fighting. That survey brought home to me especially vividly the many factors involved in maintaining fighting fitness.

In a tropical country the medical services constitute the most important of all branches of the fighting services because, given anything like equality, the side with the better medical services will win: it will have more men left to fight, and fitter men. It is the duty

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which was liked and it could be seen whether a man had tea in his water bottle or not, whereas if he had water in it no one could tell whether or not it was boiled.

Concerning water purification, we ought not to rely on chemical purification alone. No means ought to be neglected. It ought to be chemically purified and boiled and if possible, filtered.

The second great measure of prevention is the one which Hamilton Fairley developed in New Guinea, namely the *immediate* use of sulphonamides. If that is done, men are prevented from passing more than a few infected stools and ground contamination is greatly diminished.

The cure of dysentery by these compounds is an enormous advance in itself.

Skin diseases are of vital importance. They are all the simple ones that give trouble - intertrigo, prickly heat, impetigo, fungus infections of the feet and body, scabies, and so on. Their prevention is a matter of cleanliness of body and clothing, i.e. of organized facilities for men washing themselves and their clothes. Ample supplies of dusting powder are essential.

With regard to venereal diseases the methods of prevention are known. Of course there has been an enormous advance in treatment due to penicillin.

While we know how to prevent the big four, the fact remains that we still get thousands of cases whereas theoretically we ought not to get any. Why is it? The reason, I would submit, is that we have not 'got over' our doctrines sufficiently effectively. We have not convinced people. Orders are not enough. Men have a sort of hostility to orders. Just putting out an order may safeguard the man who puts it out, but it does not achieve very much. What we want is the much more effective use of propaganda. We know how propaganda can be used to publicize what is relatively unimportant. Why not use it for things that vitally matter? A medical directorate in the tropics requires a propaganda section staffed by experts which would put it over in every possible way.

The second reason why prevention is not fully carried out is that there are not enough hygienists. There are too many engaged in treatment and too few in prevention. I hope the balance may be redressed.

All the main diseases yield promptly to early treatment - malaria in one and a half to three days, bacillary dysentery in about twenty-four hours, skin diseases and venereal diseases can also be cured quickly if immediately treated. In warfare in the tropics *treatment needs to be forward* and if cases are treated at once there is no need to evacuate them hundreds or thousands of miles.

*of the space allotted to the human element, to the space allotted to the mechanical element of the total fighting machine (ship plus ship's company) which will make it the most efficient engine of war?*

Many difficulties in maintaining the health of the Navy and of teaching personnel to become hygiene-conscious in war are due to the curtailed periods of training which are necessitated by expanding a Navy in the shortest time possible to many times its peacetime total force. Hygiene will tend to suffer most if the officers of training establishments are not taught to value its importance in attaining the maximum fighting efficiency. As a result, physiology will be cut out of submarine training, the engineers will learn little about ventilation machinery, weapon instruction will encroach on periods previously given to training in hygiene and physical fitness. In addition, the quality, as well as the quantity, of health instruction will tend to deteriorate because the instructing medical officers who normally start their naval career with a six months' course in naval hygiene and medicine, now get only a mere week or two.

I wonder if here there is not another lesson to those who can read it. In the Navy necessity has forced us to turn out officers, seamen, and hospital nurses, male and female, after the briefest preliminary training, lasting months or weeks instead of years. Of course, we do not make real trained personnel in that time. But, after telling them what it is all about, we put them straight into the job they have to do, when, though having to take some responsibility, they learn the job by doing it under the supervision of those who already know it. This is really a return to the system of apprenticeship.

The system of a brief preliminary training plus 'apprenticeship' has been validated by the work of the British Navy in this war because no one dares to say the Royal Navy does not know and do its job.

To summarize, the great lesson this war has taught us is that a knowledge of practical hygiene is as important as a knowledge of gunnery to administrative, executive, and combatant personnel in defeating the enemy. If this lesson is not to be re-learned in every war, we in the medical services must make every endeavour to implement this principle of war in the intervals between wars.

these men require a periodic overhaul and the fact should be remembered that because a man can carry on in civil life it does not necessarily mean that he can carry on in the Services. During the early days of the war men who were obviously unfit were called up and drafted overseas only to be invalided back again to the United Kingdom after a few weeks or months. It is essential if a reserve is to be formed that it should be a reserve of men who can answer a call in a moment of crisis and not prove a drag on the war machine.

So far as aviation medicine is concerned there have been many advances, chiefly in the direction of prevention. At the same time a number of lessons have been learnt with regard to the relationship of actual disease to flying. In the last war all the emphasis was laid on physical fitness as the essential attribute of the pilot. Flack's test and similar methods controlled the selection of candidates. In the period between the wars we had begun to learn the lesson that too much stress was being laid on physical efficiency and not enough on the psychological aspect. This war has rubbed this lesson in, so that it should never be forgotten. It is incredible what disabilities a man can overcome if he has the right temperament for a war pilot. We have pilots flying while undergoing artificial pneumothorax treatment, one of them has actually gained a decoration. Another is flying operationally after complete thoracoplasty. At the same time there are many apparently completely fit people, who have been quite unable to stand up to the strain of flying. This lesson of the importance of the psychogenic factor can be applied with equal intensity when dealing with ordinary patients.

Another thing we have learned is the high incidence of peptic ulcer among the male civilian population. In ordinary times these people usually manage to carry on with their civilian duties, but the stress of service soon causes a breakdown. The cause of this high incidence and of the breakdown has been much debated, but the lesson we should learn is that these people are much better off in civilian life.

Turning now to respiratory conditions, the instability of the asthmatic as a pilot has been borne out time and time again. Similarly the unsuitability of the chronic bronchitic to go into a tropical climate has also been another lesson which we have learned. Eventually they nearly always break down even if free from symptoms for a long period. Climate as a factor in the treatment of disease has to some extent fallen into disrepute in recent years yet in four standard text books, under the treatment of chronic bronchitis, it was stated that they usually do well in such places as Egypt or North Africa. Medical officers whom I have met in my tours abroad have nearly always begged me to do what I could to prevent the chronic bronchitic from being sent to tropical or sub-tropical climates. Many of these patients have stated that even during the cooler weather they have been very

of every doctor in the tropics to realize the importance of his function and to urge it on commanding officers

The essential duties of the medical services are first to reduce wastage of man-power from disease, by prevention and by rapid cure and return to duty, secondly, to maintain the fighting fitness of *all* troops

We have learned what our problems are and what they will be. First of all, malaria, which is more important than all the rest put together. In the India-Burma region we had hundreds of thousands of cases of malaria. After malaria, there are three other disease groups of great importance. The first is diarrhoea and dysentery. Last year one man in ten of our total forces in the combat area went to hospital for diarrhoea or dysentery. The second is skin diseases, terribly important in hot humid climates, one in twenty went to hospital. The third is venereal diseases, which are about as common as skin diseases. Of course, there have been other conditions such as infective hepatitis, a little cholera, and the ordinary diseases of temperate climates, but those I have enumerated are likely to continue to be the important ones.

We have learned how to prevent the 'Big Four'—malaria, dysentery, skin diseases, and venereal diseases. In combating malaria the greatest agent is atabrin. If the atabrin dosage of 0.1 gm *every day without fail* is really carried out, it is most effective. Atabrin must be additional to measures of personal protection, to anti-larval measures, and to the new weapon of DDT spray, all of which are very important. We have also learned how to cure malaria with the one week atabrin course (total 3 gm) which is also used by the Americans and the Australians. We do not know how to cure benign tertian malaria, but the important thing is not to worry if we do not, but merely to treat the patient *at once* each time he has a relapse. He should then be taught to regard relapses as minor ailments.

With regard to dysentery, we know how dysentery could be prevented if measures were completely applied. The question of providing non-infected food is of first importance, and I urge also the importance of water. We found that our maximum trouble with bowel diseases was in the monsoon period. The outstanding thing about the monsoon period is rain, not flies. What happens is that men use a few tracks in the jungle and defæcate at the sides of the tracks. If they are harbouring dysentery bacilli, lines of heavy contamination are laid down alongside each track, then the rain comes down and washes the organisms into streams and pools. We know about the transmission of amœbic dysentery by water. Chlorination is not effective against amœbic cysts, but boiling is effective, and could be used more than it is. Apparently the Dutch tropical medicine experts kept down dysentery in the Netherlands East Indies by the simple device of making it an offence to drink water, tea had to be drunk,

blood are outside of the capillary bed and actually beyond the vascular tree

This is a matter of great importance. Surgeons are apt to think that only when there is visible blood loss is the condition of the patient jeopardized, but it can be seen that 3 000 c.c. of blood may be lost from the circulation when there are wounds in both thighs, without more than a few drops leaving the body. 385 231 pints of blood were actually used in medical installations in the European theater of operations from May 22 1944, to May 31 1945. Of this 194 712 pints were flown directly from the United States of America. This blood has been available as far forward as the clearing stations in combat divisions. It has been used largely in the field and evacuation hospitals in the forward area at the time of primary surgical therapy and has been used in great quantities up to 6 or 7 liters in a single individual in one day. This widespread use of blood through its easy availability has brought in its train inevitable reactions, as well as great benefit. The best figures available at this time show that about 48% of transfusions are followed by some kind of reaction: allergic reactions, 0.9%; pyrogenic reactions 38%; hemolytic reactions 0.1%. The reactions vary in different types of institutions, and as to whether the transfusion is given early or late. As a rule primary transfusions have brought little reaction. Later transfusions, given in general hospitals have often found the patient sensitized by the earlier transfusions. Pyrogenic reactions have increased where hospitals insisted upon cleaning their own glassware and not using sets furnished to them already clean and sterile. As time has gone on reactions have diminished probably because of better technique better refrigeration of the blood and through our ability always to furnish giving sets properly set up and sterilized at some central point. A particularly valuable study of these reactions following transfusion has revealed that the transfusion of large amounts of group O blood (the universal donor) and even of pooled plasma may result in serious hemolytic disease. The implication is strong that, whenever feasible strictly compatible blood of the same group as the patient should be used that where large amounts of group O blood must be used, only blood of a low titer should be administered. Such information as this and other studies now in process will doubtless have some influence on the future set up of blood banks in civilian life.

2 *Advances in otolaryngology* - The chief change in this field in World War II has been the use of radon therapy against lymphoid tissue in the nasopharynx of flying personnel. This therapy reduces the amount of lymphoid tissue and tends to keep open the Eustachian orifice and thus prevents the building up of a differential pressure in the middle ear so often disturbing to airmen.

3 *Advances in radiology* - In this field the availability of X-ray studies, even in the forward area, has been a considerable advantage



JULY 1945

## MEDICINE IN THE ROYAL AIR FORCE

AIR VICE-MARSHAL A. F. ROOK, C.B. O.B.E., R.A.F.

*Consultant in Medicine, Royal Air Force*

One of the difficulties experienced in trying to answer the question which has been set to this conference - 'Progress in War Medicine' - was how far the word 'war' limited the scope of the inquiry. Many of the medical officers to whom I have spoken in R.A.F. hospitals have commented on the wide variety of cases that come into Service hospitals. Some of the more senior ones have even said that, from the teaching point of view, the cases compare very favourably with those seen in peacetime in civilian hospitals. It seems therefore, that so far as clinical medicine is concerned the word 'war' limits the field of inquiry hardly if at all.

There have been advances of varying importance both in diagnosis and treatment of the earlier and more difficult stages of disease met with in Service life. The most spectacular advances have unquestionably been made in the treatment of diseases with penicillin and the sulphonamides. Those of us who had much to do with cerebrospinal fever can only marvel at the advances made in the control of that condition. From the purely war medicine point of view the use of mepacrine has been the greatest step forward during the war. It has permitted campaigns to be fought and won which could not have been fought without it. Malaria in the forward areas is now regarded as a minor condition. After a few days in the forward treatment unit a man goes back to duty. When one compares this with the admission to hospital, often a stay of about three weeks, then a period of convalescence, and the journey to and from the unit, it will be seen what an enormous saving of man-power this has meant.

There are, however, just one or two repercussions which are not quite fully realized. The airman, as soon as he leaves England, is submitted to a persistent barrage of propaganda telling him how serious a condition malaria is, that it is a killing disease, that under no consideration must he wear shorts, that he must never take off his shirt however hot the day, and yet if after all he is unfortunate enough to get malaria he is then informed that it is no worse than a common cold. The airman is an amenable individual in the ordinary way, but he feels that there is something wrong about this and there ought to be more consistency between the propaganda to the west of the Brahmaputra and some of the practice to the east of it.

It seems certain that the system of building up a reserve of men who have been called up from civil life will form one of the safeguards of democracy. One of the first lessons the Services should learn is that

8. *Advances in thoracic surgery* - In this field some of the greatest advances have occurred. In a study of over 1 300 cases of thoracic injured in evacuation hospitals the total operative mortality rate was 14/. Pneumothorax was present in 48/ of the cases and tension pneumothorax in 4.2%. The condition of open pneumothorax or 'sucking' wound was present in 23/ of the cases, and 21/ evidenced the combined thoraco-abdominal injury. In a study of 1 000 thoracic cases in the base area, 34/ of the cases revealed empyema, though much of this was not serious and did not stop the performance of surgical procedures such as operations for clotted and infected hemothorax. 41% of the cases went through procedures for the removal of retained foreign bodies. The total mortality in this group was 0.6/.

9. *Advances in neurological surgery* - The field for neurological surgery has made great advances. In our Army those operated upon in the forward area are largely those actively bleeding, threatened with increasing intracranial pressure or with very large retained missiles. It has been observed that less serious intracranial damage withstands transport very well and that in patients properly treated with penicillin, the advent of serious infection is no greater when such cases must wait three to four days before reaching a hospital for specialized care in the rear area. In the field of peripheral nerve surgery equally important advances have been made. Our surgeons have made every attempt to close wounds as early as possible, and in the large percentage with nerve damage have sutured these nerves at the optimum time in a clean field before returning such patients to the zone of the interior. Lately our specialists have come to the opinion that where there exists injury both to bone and nerve the definitive treatment of the fracture may even be temporarily postponed, on the basis that a flail limb is less useful than a crooked one. Thus, more and more early nerve suture has become the standard policy.

10. *Advances in anesthesia* - Every soldier submitted to a surgical procedure owes a debt of gratitude to the anesthetist. The superior ability and marked improvement in this special field have differentiated anesthesia in this war sharply from that in the last war. No field of professional labor has shown equal advance. Expert anesthetists were available all the way from field hospitals to general hospitals in the base. They have available a wide variety of agents and have adapted in tracheal, inhalation and regional anesthesia as seems best for every given case. The increasing use of local or regional anesthesia, which is the safest of all anesthetics, evidences the desire of both the surgeon and the anesthetist to take no unnecessary chances. The simplicity and safety of modern intravenous anesthesia has been a blessing to thousands of wounded men and where differential pressure is needed for intrathoracic work, the anesthetists have utilized endotracheal anesthesia for the comfort and satisfaction both of the patient and the surgeon.

little, if any, better I think that Colonel Middleton's kindly reference to the climate of this country should be remembered when dealing with these cases

## B.--SURGERY

JULY 1945

### THE U.S. FORCES

BRIGADIER GENERAL E C CUTLER, U S ARMY

*Chief Consultant in Surgery, European Theater of Operations, U.S. Army*

Everyone is agreed that there has been a high reduction in mortality rates in this war, as compared with World War I

The total wounded-in-action figures, United States Army, D-day to VE-day is 372,000 This does not include killed in action, missing, medically indisposed soldiers or NP patients It only relates to wounded-in-action troops The mortality rate of 3.9% for 372,000 wounded in action casualties is approximately a 50% reduction over the mortality rate of 8% of those wounded in action in World War I Major criteria affecting this happy result come from two sources A Professional care. B Organization and evacuation

#### A PROFESSIONAL CARE

1. *Resuscitation* - The one item in professional care which distinguishes care in this war from care in World War I, as well as the single factor most directly contributing to the improvement of morbidity and mortality statistics, is the resuscitation of the wounded man This transcends in importance any single method of therapy, such as our ability to procure and deliver blood and plasma to casualties, for it betokens that the American surgeon has at last appreciated the importance of the complete evaluation of his patients before therapy He has learned to care for the whole man and not for any portion or any particular wound This, in turn, has led to proper resuscitation methods and the better care of shock Accretions to our knowledge concerning shock have come in steadily. Dependable studies of blood volume made in forward hospitals indicate that soldiers seriously damaged have averaged a loss of at least one-third of their total blood volume, and investigators have tried to set simple standards for recognizing this deficiency Majors Emerson and Ebert have stated that a blood-pressure below 85 systolic usually betokens a loss of over one-third of the total blood volume Professor McMichael of the British Post Graduate Medical School has stated that in the male thigh an increase in diameter of some 2 cm which, to the cursory glance, would not seem great, may mean that 1,500 c.c. of

## THE LIMITATIONS OF SURGERY IN H M SHIPS IN WARTIME

SURGEON COMMANDER L. T. S. RUDD R.N.

My contribution to the discussion will be confined to an account of such surgery as is possible in His Majesty's ships in wartime and the changes in medical organization that have been deemed necessary.

My experience of two and a half years' service in a battleship in this war has clearly demonstrated to me for reasons which I hope to make clear the limitations imposed upon one from a purely surgical point of view.

In common with the other Services the main factor necessitating a change in organization is air attack.

When a ship goes to action stations she is rapidly converted into a series of watertight compartments and passage from one compartment to another between decks or from between decks to the upper deck is severely restricted. This state of affairs lasts until the danger of attack has passed. Before air attack at sea became a menace a ship went into action generally after appreciable warning had been given and when action was broken off the ship could once more be opened up. All that was required then, when action was expected, was to remove from the sick bay which is not under armour the necessary instruments and dressings to a space below armour which was designated the distributing station. In this station patients received first aid and as soon as action was broken off the sick bay was once more opened up and reverted to its normal use.

To-day a ship may go to action stations soon after leaving harbour, and may remain in this state for several days. In fact this always occurred when in narrow waters such as the Mediterranean.

A greater degree of dispersal of medical and first aid personnel stores and equipment is therefore nowadays a *sine qua non*.

The following organization has been evolved. All newly constructed ships will be fitted with an emergency operating station (E.O.S.). In ships already built the necessary alterations have been made. In the larger ships this station will be under protection, but in cruisers and small ships this ideal may have to be abandoned. This station will have adequate room for treatment and will be so fitted that there is easy access for stretcher cases. The equipment will permit of major surgery.

In addition there are numerous first aid posts (F.A.P.) placed throughout the ship their siting depending upon accessibility, lighting, water supply, etc., and generally on upper decks near guns, crews

to the surgeon, and the mobile X-ray units now in use in the European theater have proven to be of real value.

4. *Advances in urological surgery* - The great reduction in the morbidity of the venereal diseases from the use of the sulfonamides and penicillin must be mentioned as a major contribution of medical science fully utilized by the armies in this war.

5. *Advances in ophthalmology*. - The advent of penicillin resulted in a marked reduction in pyrogenic infections involving injuries to the eye. The grouping of all eye casualties at centers under competent ophthalmologists has improved both the morbidity and the mortality figures. The availability of special apparatus, such as the slit lamp and electro-magnets, has greatly increased our ability to remove small magnetic foreign bodies within the globe and has led to a better appreciation of the exact status of the injury. The use of corneal grafts in the rare instances where it has been utilized has proven often a miraculous means of saving vision.

6. *Advances in plastic surgery*. - All surgeons are under a great debt of gratitude to our colleagues in this field, notably to Sir Harold Gillies in England, who has long pointed out that only wounds that are epithelialized can be considered sterile. The impact of this dictum played a major role in our determination to close the primarily debrided wound at the earliest possible moment, whether that be by suture, by graft or by a plastic procedure. This early closure of wounds has resulted in the saving of countless days in recovery and rehabilitation of patients, and has been a major element in winning the war, since it permitted the early return to duty of wounded soldiers and thus brought strength and courage to the armies in the field. In our own group the plastic surgeons have been leaders in the better care of hand injuries and, in conjunction with their dental colleagues, have vastly improved the care of maxillofacial injuries. Further, we are indebted to this group for great improvement in the care of the burned individual, a matter of greatest importance to our airmen.

7. *Advances in orthopedic surgery*. - The delayed primary closure of wounds over compound fractures is a chief contribution to the surgery of this war. This has depended in turn on better debridement of the wound and has therefore made the surgeon more meticulous in his toilette at the primary procedure. A further contribution affecting both mortality and morbidity has been the more comfortable and protective transportation of the wounded in plaster-of-Paris splints, which have given proper immobilization. The standardization of amputation, the conservatism practised in this mutilating procedure, the use of skeletal traction in general hospitals during the period of acquiring proper alignment and union, the interest of the orthopedic surgeon in the wounded hand and in the handling of combined nerve and bone damage, represent further improvements in this special field.



## B ORGANIZATION AND EVACUATION

The facilities presented for motorized and airborne evacuation have played a large role in the decreased mortality rate. A very considerable percentage of wounded soldiers reached an army hospital within two to three hours of wounding, due to the ability of motorized transport to reach directly to battalion aid posts. Again, air evacuation from the army area to general hospitals has been rapid and comfortable as compared with the means of evacuation available in World War I. We must remember, however, that all of this could only be utilized because the Allied forces controlled the air. Thus the utilization of evacuation facilities depends upon the tactical situation and one could imagine that an army deprived of these facilities, though equipped with equal professional care to our own, would not be able to show the same reduction in mortality rates. It is only proper that doctors should recognize fully the implications of the tactical situation in appraising their accomplishments.

## SUMMARY

This short recital pays our tribute to organization, without which the care of thousands cannot be accomplished. It emphasizes that in accepting credit for the improved figures we must recognize the role of evacuation as well as expert care.

In speaking of professional improvements we must list first, as our chief improvement in this war, the proper evaluation and resuscitation of the soldier. We must next pay a tribute to the enlisted personnel of the medical department, of whom in the United States Army some 2,000 died in the battlefields performing their duties. The excellence of their first-aid care has played no small role in the happy figures we have cited.

Next, the advent of penicillin and the sulfonamides has relieved the injured soldier of the frightful disaster of terrible infection. And, in all this, the general condition of the soldier himself has played no small role. Whether he is now better fed or whether his training has given him a higher physical standard, need not be labored here. Certainly his resistance is greater because his condition is better.

Finally, we acknowledge our debt to the surgeons themselves. They have, with the aid of the sulfonamides, literally performed miracles. These surgeons were but recently civilian surgeons in the United States. To them our wounded will be forever grateful.

All that we Americans have accomplished has a background in the labors of others. Much that we have practised was learned here. No single effort in England has been so productive of help to wounded United States Army personnel as what has transpired at these Inter-Allied Conferences.

extent on how things are organized in the field. It would not be wholly true, I think, to assume that every advance in the science and technical art of surgery will automatically lead to improvement or progress in battle surgery. The test as to whether or not an advance in technique will lead to progress in the rather limited and restricted field of military surgery must depend on whether such advance can become a practical proposition for surgery under field conditions.

When considering factors which lead to progress in battle surgery we must include medical discoveries in the list. I intend to make but a passing reference to the sulpha drugs and penicillin. Had it not been for the wholesale use of these substances our surgical results would never have been so successful as they have been. I need hardly remind you that one of the sulpha group M & B 693 was the *dramatic* *cris* in medicine just before the war. We were rather rushed into employing the sulpha drugs. This rush had its drawbacks because we were not given time to establish satisfactory controls and in consequence were slow in obtaining the evidence which later enabled us to assess their value and place in this type of surgery. Accumulated experience, however, has since provided the evidence and we know how and where the group can help us. Penicillin also cannot be regarded entirely as a war discovery. Thanks to the advice and backing of the Medical Research Council, also to the fact that supplies were so small in the first instance we decided to exercise strict control of its use from the outset. The Army was the first to carry out human trials with penicillin. We employed it in selected wounds in the field all under careful control. For about two years and even when the supplies had become adequate we continued to control penicillin in the field and all our results were reported and followed up. We know a good deal about penicillin now - when and how best to use, etc. and we recognize its few limitations. Supplies are now so adequate in the Army that not a single sick or wounded soldier need fear that it will not be available to him if advised.

A third factor that has played a great part in our progress is not a new one. I refer to research. Because the problems which may arise during war are urgent and demand a prompt solution the energy and output of those concerned in research has always reached a high level during the war. Service doctors have always been alive to the value of research, but the nature of their duties and the fact that the majority are young men with little or no training in this work has precluded them from contributing much in this respect. Nevertheless we have not missed many opportunities during this war. Research projects carried out under the guidance of the Medical Research Council for the Army have been an important factor in bringing about the improvements that have been achieved.

Those are the three main factors which have helped us to make progress. If you were to ask me, Has any individual Army surgeon



and on the bridge. They are equipped to permit of full first-aid treatment, including transfusions, and are manned either by members of the sick berth staff or specially trained first-aid workers.

The medical officers are widely distributed at the more important first-aid posts, the senior medical officer having a roving commission and moving about as necessary, supervising and adjusting the organization to meet changes in the situation as they occur.

*Organization during action* - (1) Casualties are shifted to the nearest cover and receive simple first aid rendered by personnel instructed in first aid. (2) As soon as possible (i.e. in a lull) the wounded are taken on stretchers to first-aid posts, where they are examined and given further treatment. (3) No attempt is made to take wounded to the emergency operating station during action, except under the instructions of a medical officer - in any case this will usually be impossible for the reasons already given.

*After action* - The senior medical officer reviews the situation and decides where the final casualty and operating station shall be set up. The emergency operating station may be available, but in case of damage, alternative arrangements will have been made, and a site chosen, if possible below armour. As I have said, once the ship goes to action stations free access to different parts of the ship is out of the question, and wounded men may have to be detained in the first-aid posts for many hours.

The following points are worthy of mention -

*Stretchers* - Two types are supplied. (1) The Neil-Robertson stretcher, which is made of split bamboo sewn on to white canvas. Its advantages are lightness, strength, flexibility, compactness, and protection to the patient. It has fully maintained its reputation. They are indispensable for transport of wounded in a ship. These are liberally distributed throughout the ship. (2) War Office type - useful for accommodating patients on deck and for their transfer to hospital.

*Clothing* - To reduce the incidence of burns all officers and men in action wear an overall suit with the ends of the trousers tucked into the socks, antislash helmet and gloves.

*Morphia*. - The division of the ship into self-contained compartments for long periods necessitates the issue of morphia syrettes to responsible officers and to trained first-aid parties. Some medical officers criticize this. They argue that if it is necessary to abandon ship patients may be too doped to help themselves. But the benefit from the administration of morphia far outweighs its possible disadvantages.

*Blood transfusions* - The storing of a blood bank, in a ship which may be weeks at sea is not yet a practical proposition. Dried serum has been used with great success. The ship's company is blood grouped when at sea at the commencement of a commission and whole blood is collected and given in the emergency operation station after action.

special types of wounds at specially equipped centres paid a handsome dividend. I have always been a strong advocate of segregation. I favour this policy not only because I am convinced that the patient benefits, but it enables surgeons with special training and experience with their specialized equipment to be centred at the correct places, and enables them to focus attention on the various problems which these special wounds present. When we first segregated orthopaedic cases there was some opposition from the general surgeons who were inclined to criticize the number of conditions embraced by the definition orthopaedic! They felt that some officers merely because they had some orthopaedic training were getting more than their share. This opposition soon died down when it was appreciated that the orthopods had something to give that many of the general surgeons hadn't got. I might mention in passing that segregation can be a headache to the administrative side. Very often it does not work smoothly especially during a rush of casualties. Indeed it is often difficult and makes a great demand on transport. Nevertheless I am convinced that it is necessary and worth while attempting.

The development of air evacuation has already been referred to and the splendid organization worked out in co-operation with the R.A.F. has been another important factor in improving our results. Not long since I returned from a tour of inspection in Burma. Air transport has saved the day for us there. The wounded are evacuated first singly in light planes to the forward surgical centres, 40 or 50 miles behind the line, and as soon as they are fit for the next hop they are flown hundreds of miles back in complete comfort to the forward base hospitals. Without this air lift, evacuation of our wounded in Burma would have been incredibly difficult.

No talk on progress would be complete without some reference to the development of our resuscitation service. An amazing service which has rendered vital help to countless numbers of wounded men. An achievement to be proud of. Further we have learned a good deal about the effects of 'blast', whether on land or under water and its effects on the human anatomy and physiology. We also recognize crush injuries and the danger signals associated with them. There is a more widespread recognition that multiple or massive wounds of muscle especially involving the limb demand urgent surgery. Our surgeons in Italy for instance even established special forward limb centres where these cases were Group 1 for the operating theatre. I merely mention in passing the successes *en masse* that we have had in the two-stage closure of wounds. There is nothing new in this idea. We have always aimed to do this whenever primary closure has been impracticable.

This talk would be incomplete without an appreciative reference to the work done by our special surgical teams and units. Great work has been done in the Army by these teams and great progress made in

degrees To keep one's feet is difficult, soon one is covered in oil fuel, and oil permeates everywhere The water may become contaminated,

Rough seas and the necessity for zigzagging add to the difficulties, and these increase in inverse ratio to the size of the ship

Finally the possibility of having to abandon ship may necessitate the postponement of any but first-aid measures Thus it must be appreciated that major surgical procedures in wartime are rarely feasible

*To sum up* – The lessons we have learned, and already utilized, in this war as applied to a sea-going man-of-war are –

- (1) The importance of wide dispersal
- (2) The provision of an emergency operation station, suitably protected and accessible
- (3) The provision of numerous well-equipped and adequately manned first-aid posts
- (4) The importance of leaving the seriously wounded and shocked patient in the first-aid post and only removing him to the emergency operating station after shock has been counter-acted
- (5) The provision of a very liberal supply of Neil-Robertson stretchers
- (6) The importance of anti-flash clothing
- (7) The distribution of morphia syrettes to responsible officers and trained first-aid ratings
- (8) An adequate store of serum and transfusion sets
- (9) An adequate stock of plaster of Paris
- (10) Provision for *early* evacuation to a hospital ship, and finally, but by no means least important, a ship's company that is thoroughly familiar with all the arrangements that have been made for its succour

JULY 1945

## SURGERY IN THE BRITISH ARMY

MAJOR-GENERAL D. G. MONRO, C.B., C.B.E., K.H.S.

*Consulting Surgeon to the British Army*

I suggest that it is necessary, in the first place, to accept the view that the word 'progress' in the topic chosen for this meeting has special significance when applied to military surgery, because success in battle surgery may be measured both in terms of general improvement in results or in technical advances leading to improvement. In this type of surgery progress and improvement depend to a very large

the situation. That is where the air transport of casualties has played a very great part and has made quite an appreciable difference in the survival rate and in the morbidity rate.

I will pass in brief review those major conditions which we met frequently in R.A.F. personnel. First of all burns. When this war started a lot of nonsense was being spoken and printed on this subject. During the last six years we have learned one thing to treat burns as we treat wounds. If we do that according to clean, sound healthy surgical principles we diminish the mortality. Coagulants are not by any means dead, but their usefulness has been reduced to a narrow field. If normal surgical principles are applied to burns we shall get somewhere.

Another problem that affects us in the Air Force is frost bite. Bomber Command operated from Great Britain in conditions where frost bite could occur ten months out of twelve. We know that severe damage renders this an irreversible reaction and once this has happened there is inevitably loss of tissue. In the case of an airman who simply touched the metal part of his gun, the ensuing frost bite entailed the loss of fingers. Have we contributed anything to the treatment of this condition? The answer is Yes. The incidence of frost bite has been reduced to 0.02% and I doubt whether we could reduce it to much less. It has become a negligible problem. So there is here a lesson that when we fail in producing a cure we must set out selves at all costs to prevent the condition occurring at all.

The next major lesson concerns conservatism in surgery. I do not mean by conservatism sitting tight and doing nothing but doing something to conserve the limb and its function. In practice this conservatism in surgery has been forced upon us by the severity and multiplicity of the physical injuries resulting from severe air crashes. When a patient has had all four limbs fractured as well as the pelvis and the spine, one thinks twice about amputating a limb. The result of this conservatism in surgery has led to a remarkable diminution in the number of amputations.

I want to say one word about head injuries. Head injuries in the Air Force, at any rate, obey the rule of All or nothing. If the man survives his injury he will probably get away with it. His chances of survival are about equal. Thus we have a residuum of 50% of head injury cases to deal with. An analysis of head injuries showed that at the end of six months 511 out of 553 cases of concussion had recovered, and only 44 were permanently unfit for flying.

All these things led us early in the war to the conviction that we must have special centres and orthopaedic centres: burn units, plastic, maxillo-facial and other special units, have been established within the Air Force. They have given us a great deal of satisfaction. The scheme of treatment followed is one which we believe, has led to the reduction both of mortality and of permanent disability.



rudiments of mental hygiene. Over 30% of the medical discharges during the war have been on psychiatric grounds, and some part of this could have been avoided had recruiting medical boards known more of this aspect of medicine and the administrators realized rather more about the proper employment of particular groups of men, according to their mental limitations.

We have produced some impression on that considerable group of doctors, civil servants, and soldiers, who believed that the Army was the proper place for dullards psychopaths and those who were unwilling. In modern war all the Allied Armies have found it is practically impossible for these men to be useful. Considerable advances have been made in the education of Army medical officers in psychiatric problems and the marriage between general medicine and psychiatry has prospered as a result of Army experience.

(3) Selection techniques, by which men can be placed in special work, for which they are most suited and through which that 30% of the less adaptable men can be fitted into tasks where they will give good service without undue strain are essentially a part of preventive and social medicine. The insistence of psychiatrists on this point led to the introduction of the General Service Corps with its selection procedure, which has proved its value. From the point of view of morale and health of the Army, the improvement of training efficiency, the avoidance of disciplinary problems, and the increase of fitness for battle, the work carried out by the Directorate of Selection of Personnel with psychiatric assistance has made great advances. We have demonstrated that chronic neurotics, otherwise unemployable, can give good service if suitably placed occupationally; that dullards can do valuable work for the Army and be a credit to it provided they are not put to tasks which will prove impossible for them but are utilized properly in work within their competence. We know that special psychiatric sorting of men can help to produce for difficult occupations, such as parachuting, men who will not fail. Perhaps the greatest advance in selection has been in the choice of officers through the War Office Selection Boards, where the insistence on the assessment of character, personality and stability as well as intelligence, has been notably successful and is being tried in civilian life by various responsible groups.

It has become very obvious during the war that psychiatrists, and indeed medical men as a whole, must work in with their colleagues from other branches of work. The link between psychiatry, psychology and sociology has been extremely close. The future health services will need team work of this kind.

Experience in this work has shown that in future there should be joint selection for the three fighting services, as there has been in the U.S. and Canada. Where three separate forces are competing in recruitment, there will inevitably be wastage and bad placing of man power and both efficiency and morale suffer in consequence.

the special branches of military surgery. The introduction of a helmet for the motor cyclist has prevented many fatal head injuries. All these specialists in maxillo-facial, plastic and neurosurgery, the oto-rhino-laryngologists and the ophthalmic surgeons with their mobile ophthalmic units, have done wonderful work.

These, then, are the lessons we have learned and the principal ones in which we have made progress. That any progress has been made at all is due to the tremendous keenness of the younger surgeons in the forward areas, to their good team work and to the wise, sympathetic and encouraging attitude of my consultant colleagues and advisers in the field, also, and by no means least, to the wisdom and discernment of our own Director-General. Add to these things a rapid and mobile and flexible field organization, the wholesale use of prophylactic drugs, segregation of special cases, with an all-round improvement in technique and we have the reasons for our progress which constitute a very definite advance in military surgery.

JULY

## SURGERY IN THE ROYAL AIR FORCE

AIR VICE-MARSHAL SIR STANFORD CADE, K.B.E., C.B.

*Consultant in Surgery, R.A.F.*

What is really the lesson we have learned during the war? Have we learned anything? Thirty years ago when I was a first-year student I went to my first lecture given by Sir Ernest Rock Carling, and the lesson he impressed upon me was to remember the part played by *medicatrix natura* – the immense power of nature to look after the body and repair injuries and guard against infection if the body is young and healthy and fit. It seems to me that it is the physical condition of the fighting soldier or airman which in the last resort is responsible for that astonishing figure which Major-General Monro has given – 94.9% of survivals of casualties.

There has been no staggering discovery in surgical technique during this war, and there is no new universally accepted and established surgical procedure as the result of these six years of experience. Nevertheless, there is a little clarification in our minds as regards surgical principles in the treatment of wounds such as conservative excision, adequate drainage, complete immobilization and early rehabilitation. Those are the cardinal principles to keep in the forefront of the mind in dealing with any casualty. The most important of extraneous factors in the treatment of casualties was the shortening of the lines of communication. By that I do not mean distances in miles, metres or yards, I mean in time, because it is time that dominates

And finally no matter what policy has been laid down, there are times when psychiatric casualties are unloaded on general hospitals and we must be prepared to treat them. We recommend that each general hospital have a position in war establishment for a neuro-psychiatrist, but that only some of these positions need be filled.

We believe that to return a high percentage of psychiatric casualties to combat duty is inconsistent. Experience of the first three years of the war showed that in 80% of psychiatric cases, there was definite evidence of constitutional predisposition and the stresses of service were only precipitating factors. The next largest group of psychiatric casualties consists of soldiers of better type who break down because of the cumulative effect of the stresses of war. These occur in increasing numbers as a campaign progresses. Obviously neither of these types will be cured by a few days or a couple of weeks of intensive treatment. The first can't take it and the second have had it. If this is accepted, provision must be made in the theatre of war for the suitable employment of those who have broken down as combat soldiers but are still capable of useful service. Much has been done by reallocation to line of communication and base units, but some time during a campaign the saturation point for this type of personnel is reached.

We therefore made provision for the surplus by setting up special employment companies, to which were posted suitable psychoneurotic or inadequate soldiers of normal intelligence. These men did many types of useful work varying from the manual tasks ordinarily performed by the pioneer corps to semi-skilled jobs with the engineers, service corps and forestry corps. Not all the special employment companies were satisfactory. We believe that was our fault, and that the principles involved are sound. Of our best companies, one was attached to the Canadian Forestry Corps in Western Europe and two others operated well forward in Italy.

We believe in the therapeutic value of early and appropriate disposal of psychiatric casualties. Except in the cases of severe and chronic psychoneuroses, the lowering of category and immediate placement in suitable employment does more good than prolonged treatment as such. Lowering of category alone only results in temporary relief of symptoms. The soldier of lowered category who is pushed around in the holding units loses the ground that he gained while under treatment.

*Personnel selection* - No discussion of lessons gained in this war is complete without some mention of psychiatry in relation to personnel selection. Personnel selection is, of course, not new. All the great armies of history were accompanied by large numbers of artisans and courtiers, who contributed their aptitudes, skills and energies to the war effort, but who did not fight. Ghengis Khan early in the thirteenth century employed personnel selection. He appreciated that many men are by temperament unsuited to fight and these were detailed to



A further contribution is the role played by evacuation of casualties by air. What difference does this make to the patient? Is it only a question of making him more comfortable or has it any surgical implications? I believe – and I speak as one who has watched these people arrive in this country – that the technique of surgery has actually been somewhat affected by evacuation by air. The system has dictated the geographical emplacement of the mobile field hospitals of the R A F, that in turn has dictated the position of the casualty clearing stations, and that, too, has dictated the attachment of special teams. It has enabled the surgeon to practise more and more the delayed final suture, it has enabled the specialist to work according to the tactical needs of the situation, so that nobody was denied adequate surgery at any place even during the heat of battle.

*To summarize* What progress have we made during the past six years? I think we have got a better appreciation of how to apply physiological principles in the treatment of war wounds and injuries, and in the application of such physiological principles in medicine 'the sky is the limit'.

## C-NEUROPSYCHIATRY

JULY 1945

### PSYCHIATRY IN THE BRITISH ARMY

BRIGADIER J R REES, C.B.E

*Consulting Psychiatrist to the British Army* ♦

There is time only for the briefest summary or mention of some of the trends in psychiatric work which have occupied us in the British Army since 1939. Some advance has undoubtedly been made in our knowledge, and in the application of psychiatric techniques for mental health, for forwarding the war effort and for dealing with mental disorder.

(1) 'We learn from history that we don't learn from history'. This dictum has been all too true and despite the committee appointed by the War Office to consider 'shell-shock' after the 1914-18 war, practically nothing had been done to implement its recommendations for training of medical personnel, selection of recruits, and the general management of psychiatric problems in war. Had our psychiatric preparations been better, there would have been less wastage of manpower, greater efficiency, and much less human suffering.

(2) There must be better instruction in psychiatry for the medical profession, both Service and civilian, and in addition non-medical administrators and executives must be instructed in some of the

(3) Although there are wide variations in the capacities of normal soldiers to withstand stress, every soldier has his breaking point and if this is reached, he becomes a liability to his unit.

In a recent article in the *British Medical Bulletin*,<sup>1</sup> Professor Adrian has reminded us that although the alchemists never found a method of converting base metal into gold, their search through the centuries laid the foundation of modern chemistry. We do not know whether it will ever be possible to convert base material to gold, but we now appreciate that if this does occur it is unlikely to be of much benefit to mankind.

It is conceivable that by early teaching propaganda, blood and guts military training and ruthless weeding out of the unsuccessful, the British Commonwealth of Nations and the United States could produce an immense fighting force which would win its wars with very few psychiatric casualties. If this ever happens I believe that we shall find the results hateful, and the ultimate disadvantages will far outweigh the wartime advantages.

<sup>1</sup> *British Medical Bulletin* (1945) 3, Nos 1-3.

## D - PREVENTIVE MEDICINE

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### PREVENTIVE MEDICINE IN THE R A F DURING THE WAR YEARS 1939-45

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To enable flying personnel to handle powerful war aircraft of all types the Royal Air Force had to learn first to select the best human material by physiological and psychological methods, then buttress the natural attributes by providing mechanical aids to enable them to withstand the abnormal conditions encountered in flying at higher altitudes, in all climates, by day and night, as well as in manoeuvres of combat involving high acceleration and to ensure as far as possible survival in emergency i.e. during and after baling-out, ditching or crashing.

*The more important of these developments were*

(1) To provide an adequate supply of oxygen with the maximum comfort to the user, which would be reliable even in severest cold whether at his station or moving about the aircraft or baling-out. Thus, an economizer and various masks were designed and developed to prevent oxygen going to waste during expiration, to be foolproof

We therefore attempted to anchor psychiatry firmly to medicine and surgery

Throughout the war, we have combined psychiatry and neurology. At Basingstoke, we have psychiatry, neurology, neurosurgery and maxillo-facial and plastic surgery all under one roof. This combination has been satisfactory, and in future planning we would go further and recommend that a similar unit be formed and placed adjacent to a general base hospital so that we would have the benefit of all of the specialists who cannot be carried economically on the strength of a special unit.

In base areas, theatre of war, we had special neuropsychiatric wings but these were formed as increments to general hospitals. This has certain advantages and certain defects. I am not sure that it should be recommended for the future.

In forward area, we followed the British example, except that to C M F and B L A we sent divisional psychiatrists who had been attached to the divisions during their final training in U K. During this period they did valuable missionary work, both with medical officers and formation and unit commanders. This we would do again, but it must be appreciated that there are many times during a campaign when it is impractical for a specialist to be useful at divisional level. The divisional neuropsychiatrist must be used in forward area wherever his services are most needed. The whole neuropsychiatric service in the field must be kept flexible.

In lines of communication the Canadians are again slightly out of step. Because of the small size of both Canadian forces, it was impossible to give a separate neuropsychiatric service over two long lines of communication, stretching over 400 miles. We foresaw this and therefore planned to fill in the gaps by treating neuropsychiatric cases in general hospitals. To this end over a period of three years, we gave courses at Basingstoke to medical officers from general hospitals and C G S's. These courses were for a minimum of one month and many of them for as long as the M O could be spared from his own unit.

In addition we attached neuropsychiatric specialists to *some* general hospitals.

Although we were forced by circumstances to treat large numbers of psychiatric casualties in general hospitals, we have found that this has certain advantages over attempting to evacuate them all through special psychiatric units. Between 5% and 10% of the routine admissions to general hospitals have psychiatric disabilities, although the admitting diagnosis is a medical or surgical one - dyspepsia, low back pain, etc. On the other hand, some of the admissions to psychiatric centres have organic disabilities, others require special investigation to determine whether their many symptoms have organic foundation.

20,000 feet, at 2,000 feet a minute from 20 000 to 28 000 feet, and at 1 000 feet a minute up to the equivalent altitude of 37 000 feet. The three tests are carried out with a minimum interval of 48 hours between any two tests. Those who develop severe pains or chokes in the chamber test are disqualified.

Bends can be prevented or delayed by oxygenation for half an hour before flight, by maintaining warmth to dilate the capillaries and by minimizing muscular movements at higher altitudes, so as to avoid creating vortices in the blood-stream. Pressure suits or cabins also prevent the occurrence of altitude sickness, as they artificially lower the altitude to which man is exposed.

(4) *To permit man to fly in the stratosphere* at altitudes greater than 38,500 feet, where there is too little oxygen to support human life, it is necessary to compress the air or oxygen that he breathes. This was first attained by using a pressure suit at  $2\frac{1}{2}$  lb a square inch. With such a suit, Flight Lieutenant M. J. Adams in 1937 reached an altitude of 54,000 feet. The type of suit used by Adams made movement almost impossible and the vizor misted badly. This suit had to be improved for modern warfare to allow of adequate movements to manipulate the controls and guns and to prevent misting of the helmet.

For full freedom of movement, comfort and warmth in stratosphere flying it was necessary to develop and perfect pressure cabin aircraft so that with say an internal pressure of  $7\frac{1}{2}$  lb a square inch, the occupants of an aircraft flying at 44,000 feet would be in an atmosphere equivalent to that at 18 000 feet. Anxiety was felt as to the danger to man that might result if the cabin were suddenly decompressed as the result of being holed by a missile or of a port blowing. It was thought that the explosive decompression would lead to such distension of lungs and gut as to cause serious injury or death.

Researches showed however that explosive decompression causes little inconvenience to a fit man who is breathing oxygen at the time, and we have learnt by experience that a man stationed near a port should have his parachute attached in case of explosive decompression blowing him through.

(5) *Means to aid the pilot to resist blacking-out* under suddenly applied high force of  $g$  as in tight turns or pulling out from a steep dive, was a problem even during the Battle of Britain period. A normal individual in the ordinary sitting position blacks-out at about  $4\frac{1}{2}$  to 5  $g$ . Early experiments showed that raising the legs to lessen gravitational pooling of blood and crouching to reduce the height of the blood column between heart and eyes by half, raises the threshold for blacking-out by about 2  $g$ . This is adequate for most ordinary fighter or dive-bomber purposes, but for long distance work, where fatigue is also an important factor, anti  $g$ ' suits have proved to be an advantage. In these

tend the flocks and herds, move the caravans, etc., and formed the Service Corps of his Army. He also employed many skilled tradesmen who did not bear arms. We have to thank the British Services for first placing personnel selection on a broad and rational basis. During the past four years, it has advanced far – perhaps too far in some directions.

We do not believe that any of the tests or batteries of tests now employed in testing recruits accurately measure stability or the ability of the man to carry his anxieties without breakdown. We therefore think that rejection at the point of intake should not be too rigid, but that weeding out during training should be more ruthless and re-allocation because of proven unfitness should be more widely used.

The opinions I have expressed are those of neuropsychiatrists of the Canadian Army Overseas. Those that I am about to give are mine and are not necessarily held by my superiors or subordinates.

I am not convinced that psychiatry will ever solve the vast problem of the psychiatric breakdown of soldiers during war. It is my opinion that the methods now employed in the British, American and Canadian armies will not materially lower the incidence of psychiatric casualties in a fighting force. There are various reasons for these opinions but two of them are fundamental. First, there is direct conflict between the needs of the Service and the needs of the individual soldier as assessed by his physician. Secondly the attitudes and behaviour of the successful soldier are contrary to most of his previous teaching. He must adopt a detached attitude toward the mass destruction of human life. Property ceases to have value except in relation to his comfort and success as a soldier. He must not allow death or mutilation of his comrades to prevent him reaching his objective, and finally, he must pretend that he is glad to risk or lose his life for the cause.

These basic conflicts will always exist in armies such as ours, which are composed largely of citizens who become soldiers, either voluntarily, or by compulsion for a short period. It is right that this should be so.

This is not a plea for sympathy for the inadequate soldier who is unable to stand the stresses of prolonged combat, nor is there any wish that discipline be relaxed or that any of the defections which fall under the heading of cowardice in the face of the enemy should be condoned. It is a plea for the adoption of realistic attitudes toward the reactions of normal men and women to the stresses of war.

We who formulate medical policy should keep constantly before us certain premises which we believe to be true, but which we have ignored in practice –

(1) An army's killing power is not necessarily proportionate to its numerical strength.

(2) We fight our wars with the human material we have and not with what we think we would like.

- (d) The *disinsection* of aircraft and control of mosquito breeding by aërial spraying of D.D.T.
- (e) The *cooling* of aircraft on the ground in hot climates and protection of those servicing aircraft.

(7) *Accidents and emergencies*—A brief reference must be made to such emergency problems as crashing, baling-out and ditching. The human element is considered to be the main factor concerned in the great majority of accidents, and there is no doubt that fatigue is a prime cause. Strenuous attempts have therefore been made to lessen fatigue and improve performance by introducing good seating, adequate air conditioning and the proper design of controls and instruments, as well as by many other means already mentioned.

- (a) To lessen accidents from sudden deceleration during take-off and landings, *safety belts* have been provided. The lap type is apt to cause a fracture in the dorsal lumbar region, with serious results and long healing time; whereas, shoulder harness materially lessens the risk of flexion fractures of the spine and is the normal type used by air crew. Suits and harness are designed to resist high forces of g—up to 26 g. In the event of an impending forced landing, *crash positions* have been worked out for all categories of air crew so as to give the maximum protection, particularly to the skull, as the great majority of skull fractures are fatal whether accompanied by multiple injuries or not.
- (b) *Baling-out*.—As a result of researches and developments, improved points of attachment of parachutes, as well as technique in landing, have been worked out, so that during parachute training the incidence of injuries is under  $\frac{1}{100}$ , the part most commonly injured being the legs which form 70% of cases. It has been shown that injury is more frequent in those over 25 years of age, the injury rate rising rapidly with increase of weight and height.

In jungle warfare it is important to be able to parachute into a clearing, especially in rescue work. For this purpose large slotted parachutes have been developed.

In parachute descents from higher altitudes there are the added problems of oxygen want and severe cold ( $-55^{\circ}\text{C}.$ ). It was proved experimentally that the average fit man can remain unconscious and yet live for a period up to seven and a half minutes during a descent between altitudes of 35,000 to 20,000 feet. But the head of the unconscious parachutist falls forward and tends to cause respiratory embarrassment. For this reason an emergency bale-out oxygen set (10 minutes supply) was introduced, and has added greatly to the confidence of air crew operating at higher altitudes.

- (c) *Ditching*.—It was found that injuries in aircraft crashes can be reduced by supporting the body over as large an area as possible, and by preventing the skull from hitting unyielding objects of small size. A posture facing aft is easier to protect from serious injury than one facing forwards. The ideal posture is to lie or crouch with arms and legs flexed back and head fully supported, facing aft. Crash positions for all members of air crew have been worked out and are practised as speed is imperative. Dinghy drill is also of prime importance, and much has had to be learnt regarding essential items for the dinghy such as rations, water and methods of making drinking water from sea water.

A light, inflatable suit to guard against exposure was designed and developed for air crew to don either just before baling-out or ditching if

against stoppage of flow should the respiration become minimal as during shock or unconsciousness

Repeated improvements in design of mask were necessary to avoid freezing and blockage at temperatures of  $-55^{\circ}\text{C}$  or less. Incidentally, apparatus was designed for use in larger aircraft to produce oxygen from the air while in flight

The lesson learned here was that provision of good equipment was not enough. It was necessary to make every member of air crew oxygen-minded by demonstration of the ill effects of oxygen want in the low pressure chamber, where all flying altitudes and rates of aircraft climb and descent can be simulated; also to realize the need to test his oxygen equipment himself by a special test-rig before every flight

(2) To devise *means of protection against cold and frost-bite* by development of suitable clothing, including electrically heated flying suits, waistcoats, gloves and boots. It was necessary to find out where applied heat would be most effective, either peripherally or centrally to limbs or body, particularly over the course of blood-vessels. Heating filaments had to be designed and placed so as not to interfere with movements, and to avoid overheating at any particular spot, thus leading to burns

Actually, during 1944-1945, frost-bite only occurred in one case in every 12,000 individuals engaged in bomber sorties when flying at altitudes between 20,000 and 25,000 feet, with external air temperatures varying between  $-30^{\circ}$  and  $-55^{\circ}\text{C}$

The main lessons learned were that crew discipline regarding clothing is a potent factor in preventing frost-bite and that for this purpose reliance should not be placed on cabin heating for war planes, particularly as they may be holed in combat

(3) To prevent or delay occurrence of 'bends' (or decompression sickness) at altitudes between 30,000 and 38,000 feet was an early problem in connection with photographic reconnaissance work. Bends appear to be due to nitrogen being liberated from the body fluids and tissues more rapidly than it can be disposed of by the lungs. Small bubbles of the gas coalesce and form larger ones, which block capillaries, especially those in the nervous system, joints and the eye. Thus, the commoner symptoms are itching of the skin, acute joint pains and blind spots. Bends do not occur usually until after half an hour or more at altitudes between 30,000 and 38,000 feet, and pass off on recompression at 25,000 feet

Extensive experience throughout the war has shown that individuals can be selected by appropriate decompression chamber tests - approximately 10% of fit young air crew fail to pass the test. This test consists of a stay of two hours in the low-pressure chamber at an equivalent height of 37,000 feet, after a rate of climb at 3,000 feet a minute to

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suits, either water or air automatically equalizes the internal pressure built up in the fluids of the body as 'g' is applied, thus maintaining an adequate circulation to the brain and eyes. Even in relatively straight flying a certain amount of blood gravitates to the more dependent parts, especially in long flights a properly graded anti-'g' suit prevents this and so lessens fatigue and helps to maintain a good reaction time.

The water-filled suits proved clumsy to wear, took time to fill, were uncomfortable at the ready and during long flights they compare unfavourably with the pneumatic suit which can be slipped on almost like a pair of slacks, and is light and comfortable to wear. The danger of wearing such suits is that pilots may overstress their aircraft or their own hearts with serious results.

(6) Time does not permit more than passing mention of many other problems tackled and solved to improve man's efficiency in flying, for instance :-

- (a) Protection of vision against *sun and searchlight glare* by special glasses and other devices
- (b) Means of obtaining and maintaining the *maximum night visual acuity* by pre-adapting with red goggles, and using red or ultra-violet lighting reduced to the minimum to illuminate instruments and maps
- (c) The effect of *oxygen*, diet and drugs on *night vision*
- (d) *Night vision testing* and selection of personnel for special duties, as even with radar the final identification of aircraft is visual
- (e) *Training* personnel how to see and search most effectively
- (f) *Improved hearing tests* with audiometer plus *aircraft noise* background to simulate intercommunication in aircraft.
- (g) Improved design of *microphones* and *earphones* to increase acoustic reception and so lessen fatigue
- (h) Design and development of *flying helmets* to give perfect fit with comfort even when worn for hours
- (i) Proof of the occurrence of *high tone deafness* as the result of flying for 100 or more hours without ear protection in non-sound proofed cabins
- (j) Means of preventing and treating acute *otitic barotrauma* by X-ray or gamma radiation
- (k) Study of the causes of *dental pain at altitude* and its prevention by proper conservative dentistry, using cement of the correct pH and avoiding undue heat near the tooth pulp
- (l) Study of *air sickness* and its prevention, and discriminating between true airsickness and emotional tension.
- (m) *Design of cockpits* and *seats* for comfort, removal of projections likely to cause injury, placing of all controls in the most favourable position - the problem is whether the most often used controls or those needed in emergency should have the place of vantage
- (n) Simplification of *instrument dials* for ease of reading, grouping of instruments so as to cause the minimum of error and fatigue.
- (o) *Prevention of flash burns* by introducing and using self-sealing tanks and proper fire-resisting clothing

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time permits, or after entering the dinghy. It weighs only 2½ pounds and rolls up to form a stole for the Mae West. Even if it is not put on until the dingy is boarded, it will protect the wearer against further loss of body heat despite wet clothing underneath.

Various life-saving jackets were tested for their efficiency to keep an injured or unconscious man from drowning. It was found that an extra two-pound lift in the back was necessary for rough waters, consequently a new Mae West jacket was introduced.

This is a high-speed, bird's-eye view of the progress made in aviation medicine during the war, and the main lessons learnt are that Service trials of all equipment and devices for the use of the aviator are essential; that the 'goods' must be sold unbiassedly to an crew; and that there must be the utmost liaison and team work between scientists and industrialists, if the maximum progress and efficiency are to be achieved.

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